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1	2	6082219.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2002/10/31 12:27
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3	1		USPAT	2002/10/31 12:26
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5	1		USPAT	2002/10/31 12:27
6	1		USPAT	2002/10/31 12:27
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8	175	(74/512.ccls. and cable) and arm	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2002/10/31 12:28

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Forssell et al.

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(54) **METHOD FOR ACTIVATION OF A SAFETY ARRANGEMENT IN A VEHICLE**

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(52) **U.S. Cl.** **180/275**; 180/282; 74/512; 303/20; 303/15
(58) **Field of Search** 180/275, 274, 180/282; 74/512, 513, 514, 560, 561; 301/20, 15, 166, 122, 152, 122.03

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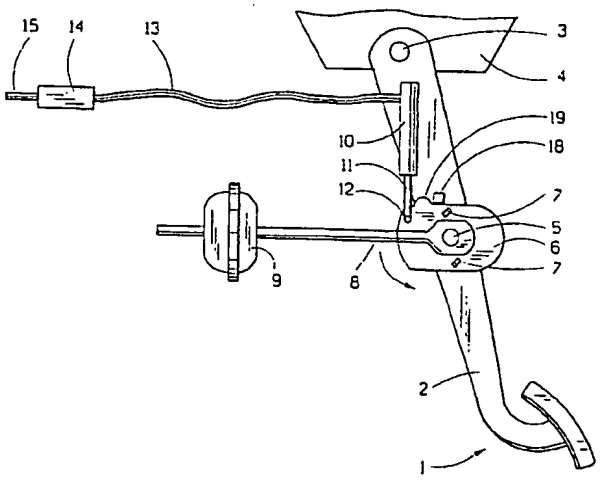
(57) **ABSTRACT**

Apparatus and methods are provided for the activation of a safety device associated with a vehicle pedal in a vehicle including an engine compartment, a pedal arm, a push rod connected to the pedal arm, and an acting rod for acting upon the push rod, the apparatus comprising an actuator for releasing the push rod from the pedal arm upon actuation thereof, and a sensor for actuation of the actuator in response to detection of a condition of the vehicle corresponding to a collison, the sensor being disposed in a zone within the vehicle defined by first and second distances displaced from the front edge of the vehicle, these distances being selected whereby the zone defines a location in which deformation occurs upon a collision at a predetermined speed and corresponding to minimum and maximum time delays for activation of the sensor after deformation of the vehicle.

19 Claims, 5 Drawing Sheets



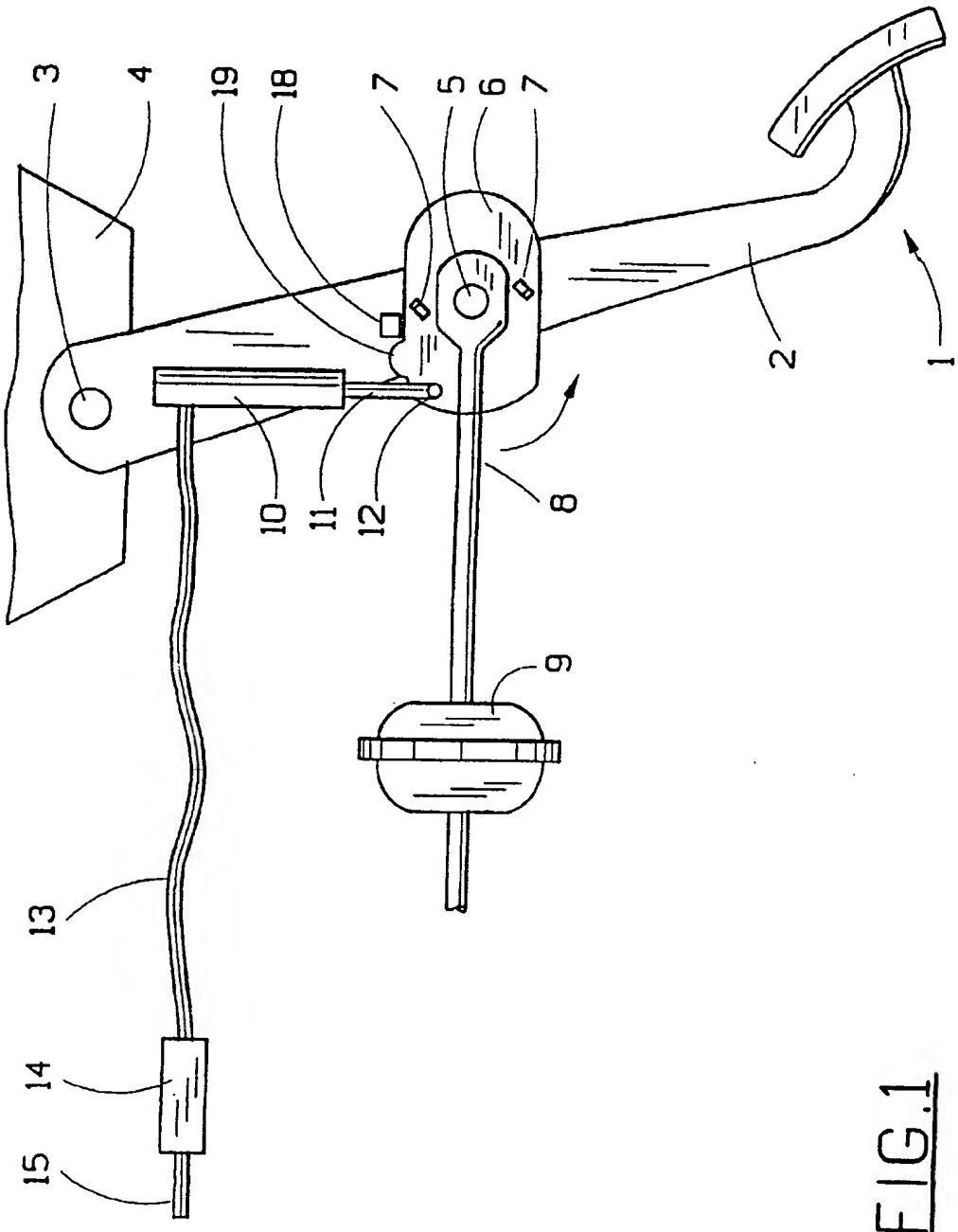


FIG.1

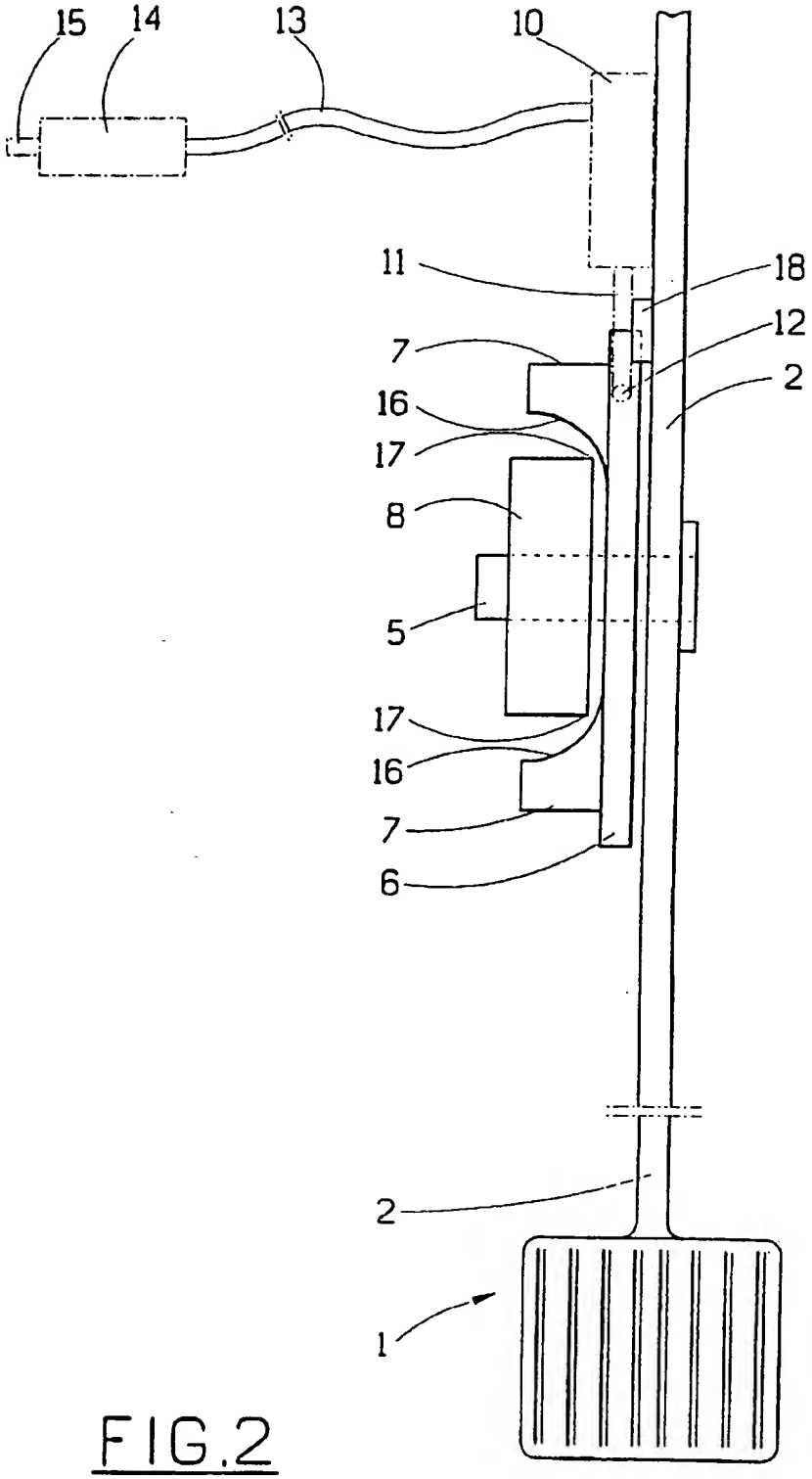


FIG.2

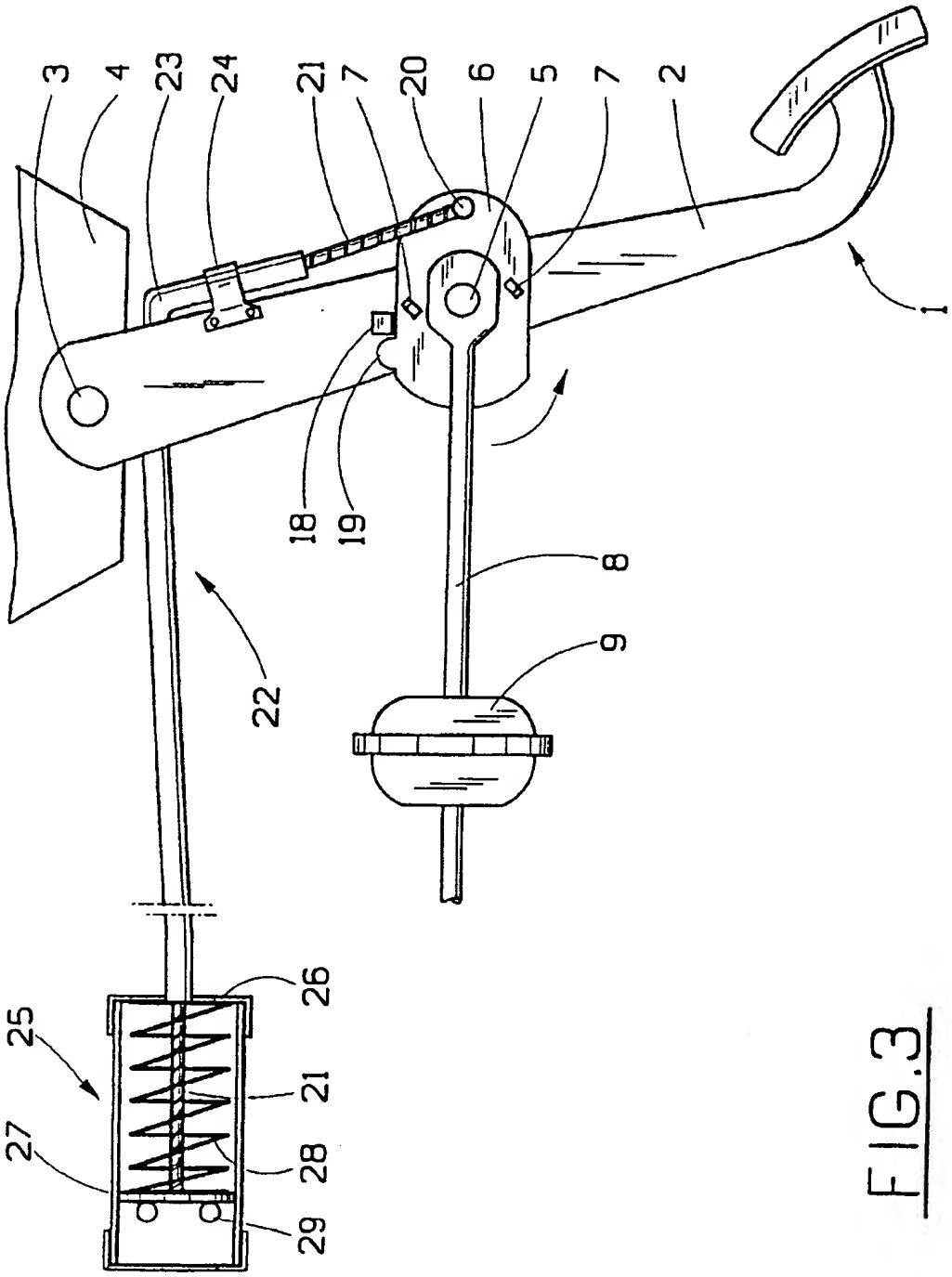


FIG.3

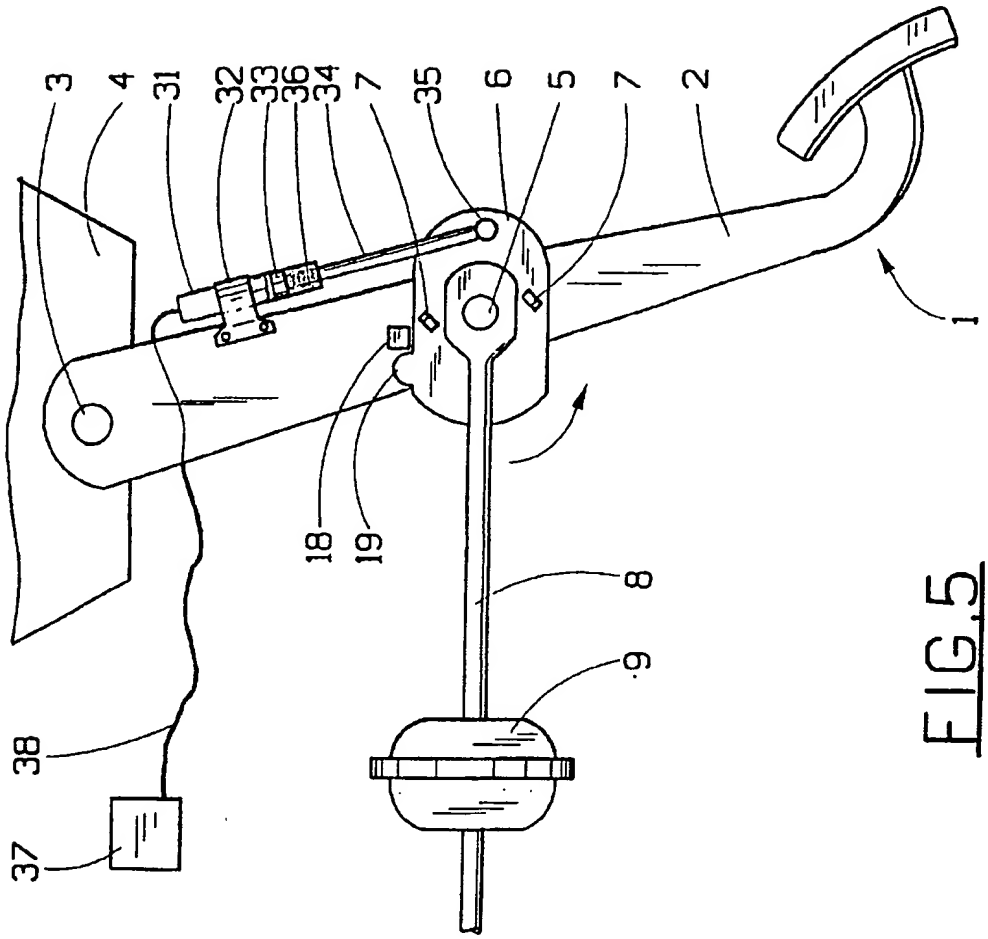


FIG.5

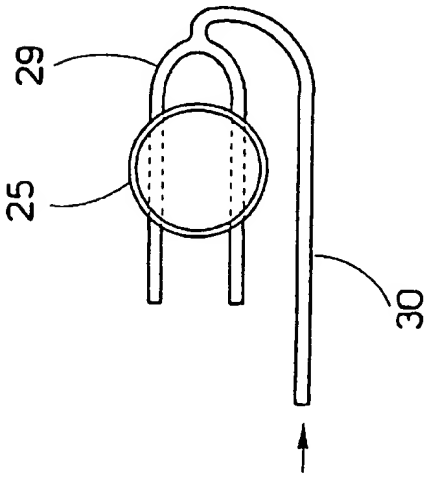


FIG.4

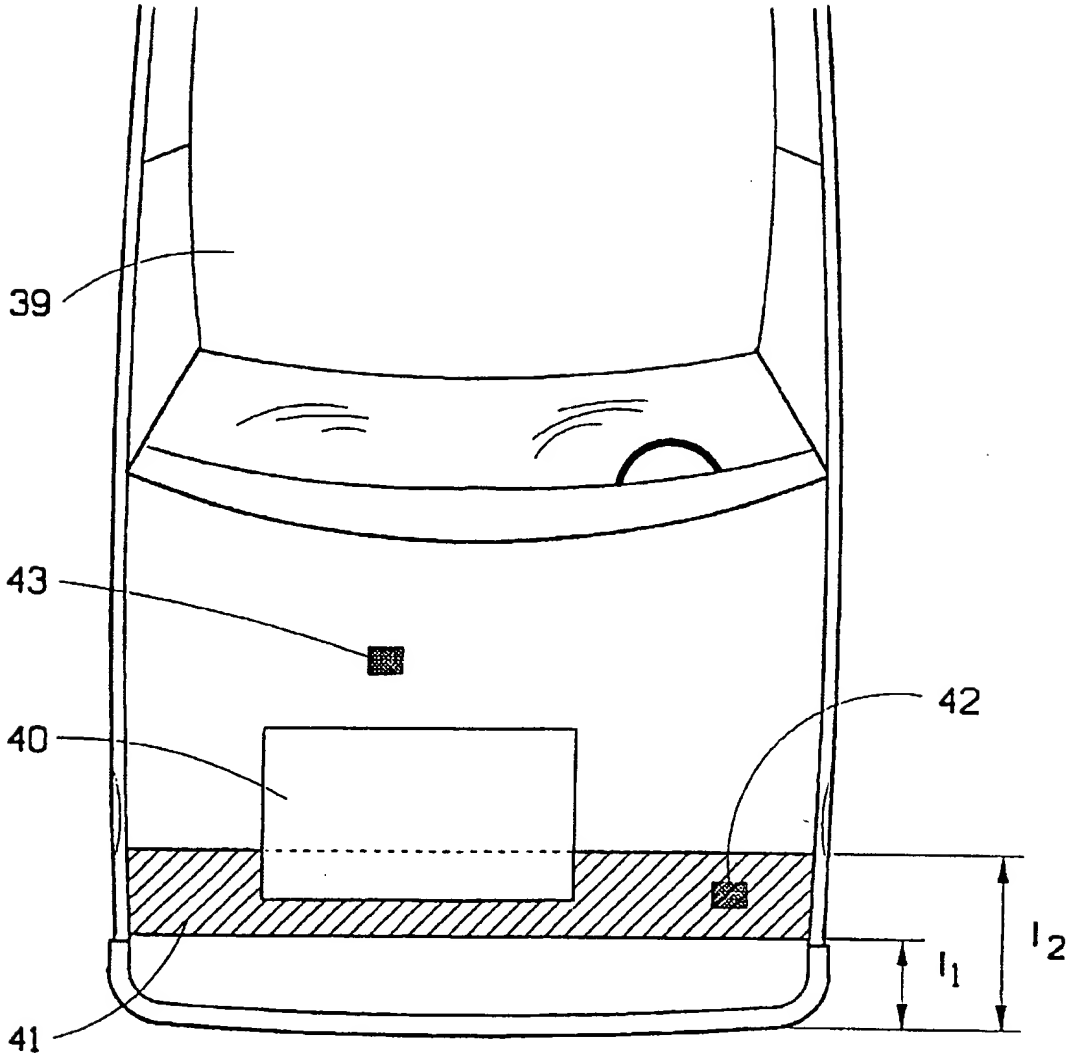


FIG.6

METHOD FOR ACTIVATION OF A SAFETY ARRANGEMENT IN A VEHICLE

SUMMARY OF THE INVENTION

The present invention relates to apparatus for activation of a safety device in a vehicle. More specifically, the present invention relates to a method for such activation. Still more particularly, the present invention can be applied in connection with activation of a safety device for brake pedals in motor vehicles.

BACKGROUND OF THE INVENTION

In the field of vehicles, such as passenger cars, it is common to use brake systems which comprise a brake pedal which is connected to a push rod, which in turn is connected to the servo mechanism of the brake system, i.e., the so-called brake booster. The brake booster is normally arranged in the rear part of the engine compartment of the vehicle.

In the event of a head-on collision, a deformation of the front part of the vehicle normally occurs. In some cases, this deformation can be so powerful that the front part is compressed, which causes the engine and other components in the engine compartment to be pressed against the brake booster with a high force. This causes the brake booster to exert a high force upon the push rod, which in turn causes the brake pedal to impart a short but intensive blow on the foot of the driver, before any deformation of the firewall takes place. In this manner, the pedal is caused to pivot into the passenger compartment of the vehicle in a direction towards the driver. This is a severe problem since the brake pedal might cause serious injuries to the feet and legs of the driver.

A known brake pedal arrangement which is intended to solve this problem is known from the Swedish Patent No. 465,769. This arrangement comprises a push rod which is pivotally arranged in the brake pedal arm and which is designed with a twisted part which can interact with side edges of the brake pedal arm. If the brake pedal arm (being, for example, affected by the brake booster in a collision) is thus pivoted more than a certain angle in relation to the push rod, the twisted part will affect the brake pedal arm so as to displace the push rod axially in a direction away from the pedal arm. In this manner, the push rod can be released from the brake pedal arm in the event of a collision.

Although this previously known arrangement functions satisfactorily in most types of collisions, there is a need to control release of the push rod from the brake pedal arm in a more active manner, for example so that it can be released even if the push rod has not been pivoted a predetermined angle in relation to the brake pedal arm. In this manner, release of the brake pedal from the push rod might take place at an earlier stage during a collision, which would provide improved protection against feet and leg injuries.

Another known arrangement of a similar kind is shown in European Patent No. 659,615. This arrangement comprises a pedal suspension with two arms, between which a pedal is pivotally suspended about a shaft. Each arm comprises a deformable part with a bearing in which the shaft is suspended. If the arrangement is affected by a predetermined force, the bearings will be detached from the shaft and the brake pedal is released. However, this arrangement implies a drawback in that it will not be activated until the drive train of the vehicle has begun to penetrate the firewall.

SUMMARY OF THE INVENTION

Consequently, an object of the present invention is to solve the above-mentioned problems and to provide an

improved arrangement which is primarily intended for vehicles, and which provides for quick and effective release of a brake pedal from a push rod in the event of a collision. In particular, such release must take place before any part of the drive line of the vehicle has come into contact with the brake booster.

In accordance with the present invention, this and other objects have now been realized by the invention of apparatus for activation of a safety device associated with a vehicle pedal in a vehicle including a front edge, an engine compartment, a pedal arm, a push rod connected to the pedal arm, and acting means for acting upon the push rod, the apparatus comprising an actuator for releasing the push rod from the pedal arm upon actuation thereof, a sensor for actuation of the actuator in response to detection of a condition of the vehicle corresponding to a collision, the sensor being disposed in a predetermined zone within the vehicle, the predetermined zone being defined by a first distance proximate to the front edge of the vehicle and a second distance distal from the front edge of the vehicle, the first and second distances being selected whereby the predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed and corresponding to a time delay between a minimum time delay corresponding to the first distance and a maximum time delay corresponding to the second distance for activation of the sensor after such deformation.

In accordance with one embodiment, the vehicle includes at least one rigid body, and wherein at least one of the first and second distances is extended rearwardly in the vehicle by the intervening presence of the at least one rigid body.

In accordance with one embodiment of the apparatus of the present invention, the sensor comprises a hydraulic cylinder which mechanically detects the condition of the vehicle.

In accordance with another embodiment of the apparatus of the present invention, the sensor comprises a cable connected to the actuator, a spring member attached to the cable for biasing the cable into a first biased position in which the actuator is actuated, and a yoke element limiting movement of the cable towards the first biased position, whereby upon detection of said condition the yoke element is displaced from limiting the movement of the cable into the first biased position.

In accordance with another embodiment of the apparatus of the present invention, the apparatus includes a shaft extending from the pedal arm, the push rod including at least one opposed surface and being mounted on the shaft, the actuator comprising a pivoting member pivotally mounted on the pedal arm, the actuation of the actuator by the sensor comprising pivoting of the pivoting member, the pivoting member including at least one cam surface for interacting with the at least one opposed surface of the push rod upon pivoting of the pivoting member so as to dismount the push rod from the shaft. In a preferred embodiment, the pivoting member is pivotally mounted on the shaft, whereby the dismounting of the push rod from the shaft comprises axially displacing the push rod out of engagement with the shaft.

In accordance with another embodiment of the apparatus of the present invention, the at least one cam surface comprises a tongue-shaped member protruding substantially perpendicularly from the pivoting member.

In accordance with the present invention, a safety device is provided for association with a vehicle pedal in a vehicle comprising a console, a pedal arm pivotally mounted with respect to the console, a push rod connected between the

pedal arm and a control device for the pedal arm including at least one opposed surface, a shaft extending from the pedal arm, the push rod being pivotally mounted on the shaft, the safety device comprising a pivoting member pivotally mounted on the pedal arm, the pivoting member including at least one cam surface for interacting with the at least one opposed surface of the push rod upon pivoting of the pivoting member so as to dismount the push rod from the shaft, and an actuator for pivoting the pivoting member before any part of the engine compartment effects the push rod during a collision.

In accordance with one embodiment, the pivoting member is pivotally mounted on the shaft, whereby the dismounting of the push rod from the shaft comprises axially displacing the push rod out of engagement with the shaft. In a preferred embodiment, the at least one cam surface comprises a tongue-shaped member protruding substantially perpendicularly from the pivoting member.

In accordance with one embodiment, the safety device of the present invention includes a sensor for actuation of the actuator in response to detection of a condition of the vehicle corresponding to a collision. In one embodiment, the actuator includes a first hydraulic cylinder connected to the pivoting member, whereby the sensor causes the pivoting member to pivot in a predetermined direction in response to detection of the condition. In a preferred embodiment, the sensor includes a second hydraulic cylinder connected to the first hydraulic cylinder for actuating the first hydraulic cylinder upon mechanical activation of the sensor.

In accordance with one embodiment of the safety device of the present invention, the sensor comprises a cable connected to the pivoting member whereby the cable is actuated by the detection of the condition by the sensor. In a preferred embodiment, the safety device includes a spring member attached to the cable for biasing the cable into a first biased position in which the actuator is actuated, and a yoke element limiting movement of the cable towards the first biased position, whereby upon detection of the position the yoke element is displaced from limiting the movement of the cable into the first biased position.

In accordance with one embodiment of the safety device of the present invention, the sensor comprises an acceleration sensor, and the safety device includes a pretensioning member connected to the pivoting member whereby the acceleration sensor causes the pretensioning member to pivot the pivoting member in a predetermined direction in response to detection of the condition.

In accordance with one embodiment of the safety device of the present invention, the least one cam surface obliquely extends from the plane of the pivoting member.

In accordance with the present invention, a vehicle is provided including the safety device wherein the sensor is mounted in a predetermined zone within the vehicle defined by a first distance proximate to the front edge of the vehicle and a second distance distal from the front edge of the vehicle, the first and second distances being selected whereby the predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed.

In accordance with the present invention, a method is provided for activation of a safety device associated with a vehicle pedal in a vehicle including a front edge, an engine compartment, a pedal arm, a push rod connected to the pedal arm and acting means for acting upon the push rod, the method comprising detecting a condition of the vehicle corresponding to a collision by means of a sensor, and releasing the push rod from the pedal arm in response to the detecting of the collision, the detecting of the collision including a time delay between the collision and the releasing of the push rod, the time delay being provided by disposing the sensor in a predetermined zone within the vehicle, the predetermined zone being defined by a first distance proximate to the front edge of the vehicle and a second distance distal from the front edge of the vehicle, the first and second distances being selected whereby the predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed and corresponds to the time delay being between a minimum time delay corresponding to the first distance and a maximum time delay corresponding to the second distance.

According to the present invention, a method is provided for activation of a safety device associated with a vehicle comprising a console, a pedal arm pivotally mounted with respect to the console, a push rod connected between the pedal arm and a control device for the pedal arm including at least one opposed surface, a shaft extending from the pedal arm, the push rod being pivotally mounted on the shaft, the method comprising pivoting a pivoting member mounted on the pedal arm, the pivoting member including at least one cam surface for interacting with the at least one opposing surface of the push rod upon pivoting the pivoting member, and guiding the cam surface so as to dismount the push rod from the shaft before any part of the engine compartment effects the push rod during a collision.

The apparatus according to the present invention comprises actuation means for releasing the push rod from the pedal arm and a sensor for activation of the actuation means in case of detection of a condition generally corresponding to a collision. In accordance with the present invention, the sensor device and the actuation means are arranged to release the push rod from the pedal arm before any part of the engine of the vehicle or any other part in the engine compartment acts upon the push rod. In this way, a quick and effective release of the push rod from the brake pedal arm in the event of a collision is obtained.

Furthermore, according to the present invention, a pedal arrangement comprising a pedal arm with a shaft and a particular pivoting element are provided. The pivoting element is pivotally arranged on the pedal arm and also comprises at least one cam surface which can cooperate with the push rod. The invention further comprises actuatable means, by means of which the pivoting element can be forced to pivot so that the cam surface of the pivoting element causes the push rod to be displaced out of engagement with the shaft.

In this manner, the push rod can be released from, the pedal arm before any part of the engine of the vehicle or any other part in the engine compartment can act upon the push rod, which provides quick and effective releasing of the push rod from the brake pedal arm should a collision occur.

According to a particular embodiment, the present invention comprises a sensor device which is arranged to activate the pivoting element to be pivoted about the shaft. According to this embodiment, the sensor device comprises a hydraulic cylinder which can affect another hydraulic cylinder so that the latter one pivots the pivoting element about the shaft. According to yet another embodiment, the sensor device comprises a wire which is biased by means of a spring. This spring can be released so that the wire causes the pivoting element to pivot, by means of the force of the spring.

BRIEF DESCRIPTION OF THE FIGURES

The invention will be described in the following detailed description in greater detail with reference to the appended drawings, in which

FIG. 1 is a side, elevational, partially schematic view of a pedal arrangement according to a first embodiment of the present invention;

FIG. 2 is a front, elevational, partially enlarged view of the embodiment shown in FIG. 1;

FIG. 3 is a side, elevational, partially schematic view of a pedal arrangement according to a second embodiment of the present invention;

FIG. 4 is a side, elevational view of a sensor arrangement which can be used in the embodiment of the present invention shown in FIG. 3;

FIG. 5 is a side, elevational, partially schematic view of a pedal arrangement according to a further embodiment of the present invention; and

FIG. 6 is a top, elevational, partial view of a vehicle, illustrating the function of the present invention.

DETAILED DESCRIPTION

Referring to the Drawings, FIG. 1 shows a schematic side view of a pedal arrangement which can be used in the present invention. The pedal arrangement comprises a brake pedal 1 with a brake pedal arm which is pivotally arranged about a shaft 3 in a console 4. In a manner which is conventional, the console 4 is arranged on the underside of a dashboard (not shown) of a vehicle such as a passenger car.

The pedal arm 2 comprises an aperture which supports a further shaft 5. A pivotable element in the form of a plate 6 is pivotally arranged on the shaft 5 and comprises at least one, and preferably two, tongues 7 which protrude in an essentially perpendicular direction from the plate 6, and which are slightly oblique in relation to the horizontal plane. The design and function of the tongues 7 will be described in detail below. On the outside of the plate 6, a push rod 8 is pivotally arranged on the shaft 5. The push rod 8, which preferably is made from flat iron, is connected to the brake system of the vehicle, to be more precise to its brake booster 9. The other parts of the brake system are conventional and for this reason they will not be described in detail. The push rod 8 and the plate 6 are held in place in the normal condition, as shown in FIG. 1, by means of a locking washer (not shown) or the like, which is arranged at the outermost position on the shaft 5.

Furthermore, a first cylinder 10 is arranged on the pedal arm 2. The first cylinder 10 is preferably of the hydraulic kind and comprises a piston (not shown) and a rod 11 which can be affected so as to protrude out of the cylinder 10 if hydraulic liquid under pressure exists in the cylinder 10. The rod 11 is pivotally attached to an attachment point 12 in the plate 6.

A conduit 13 for hydraulic fluid is arranged between the first cylinder 10 and a second cylinder 14. According to this embodiment, the second cylinder 14 is arranged to function as a collision sensor. To this end, it is arranged in the front part of the vehicle. The second cylinder 14 comprises a rod 15 which, when depressed, affects a piston (not shown) so as to force hydraulic liquid in the direction towards the conduit 14 and the first cylinder 10.

The second cylinder 14 is arranged in the vehicle in such a way that deformation of the vehicle in the event of a head-on collision will cause the rod 15 to be depressed. In this manner, hydraulic liquid is fed through the conduit 13 and into the first cylinder 10. This causes the rod 11 of the first cylinder 10 to protrude a certain distance. In turn, this causes the plate 6 to pivot a certain angle in the counter-clockwise direction, i.e., in the direction indicated with an arrow in FIG. 1. The arrangement of the second cylinder 14 in a vehicle will be described in detail below.

With reference to FIG. 2 in which the shaft 5, the plate 6, the tongues 7, and the push rod 8 are shown slightly enlarged for reasons of clarity, it will now be realized that when the plate 6 is pivoted as has been described above, the tongues 7 will come into contact with the push rod 8. In this way, the tongues 7 will cause the push rod 8 to be displaced in an axial direction away from the plate 6, i.e. to the left as shown in FIG. 2. In order for the tongues 7 to be able to push the push rod 8 in an axial direction, the tongues are arranged so that they protrude in a mainly perpendicular direction from the plate 6, i.e., in the direction of the push rod 8. Furthermore, each of the tongues has an edge 16 which is rounded, oblique, or shaped in a corresponding manner, which edge will come into contact with the push rod 8, preferably with the corner edges 17 thereof, when the plate is pivoted as described above. When the push rod 8 has been displaced far enough axially to the left, it will fall off the shaft 5. In this manner, the push rod 8 is released from the pedal arm 2.

As will be described in detail below, the second cylinder 14 is arranged in such a manner in the vehicle that it will be affected by a deformation of the front part of the vehicle at an optimally chosen point in time during a collision. In particular, the first cylinder 10 can be activated so that the push rod 8 is released from the brake pedal arm 2 at such an early stage of a collision that the push rod 8 does not transfer any force to the brake pedal.

With reference to FIGS. 1 and 2, it can be seen that the brake pedal arm 2 is provided with a protrusion 18 which protrudes from the brake pedal 2 and serves as a stop which interacts with a protruding part 19 of the plate 6. In this way, the plate 6 is prevented from pivoting too far in the clockwise direction (see FIG. 1).

FIG. 3 is a schematic side view of a pedal arrangement according to a second embodiment. The parts which correspond to those shown in FIGS. 1 and 2 are denoted with the same reference numerals in FIG. 3. The main difference between the two embodiments is that the embodiment shown in FIG. 3 employs a mechanical power transmission for pivoting the plate 6, whereas the embodiment shown in FIGS. 1 and 2 utilizes a hydraulic power transmission for pivoting the plate 6.

According to the embodiment shown in FIG. 3, the plate 6 is provided with an attachment 20 in which a wire 21 is arranged. The wire 21 comprises the inner cable of a mechanical cable 22, the outer sheath 23 of which is fixed to the brake pedal arm 2 by means of a clamp 24 or the like. Furthermore, the cable 22 is connected to a sensor device 25 which is preferably accommodated in a cylindrically shaped body. The outer sheath 23 of the cable 22 is fixed on one of the end walls of the sensor device 25, i.e., the end wall 26, whereas the inner wire 21 extends into the sensor device 25. Furthermore, the inner wire 21 is fixed to a holding plate 27 which can be displaced longitudinally in the sensor device 25. Between the holding plate 27 and the end surface 26, a spring 28 is arranged, which spring is biased so that it acts upon the inner wire 21 in a direction inwards into the sensor device 25, i.e., to the left in FIG. 3. The holding plate 27 is held in place by means of a yoke 29 which preferably is U-shaped and the legs of which extend through the wall of the sensor device 25. In its assembled condition, the yoke 29 prevents the holding plate 27 from being displaced to the left, i.e., the yoke 29 acts to maintain the spring 28 in its biased state.

The sensor device **25** is shown in an end view in FIG. **4**, in which the position of the yoke **29** can be seen more clearly.

According to this embodiment, the yoke **29** is arranged so that it can be pushed out of the sensor device **25** in the event of a collision. To this end, the yoke **29** is preferably connected to a bar **30** which is arranged such that, when affected in the direction indicated by means of an arrow in FIG. **4**, it will cause the yoke **29** to be displaced out of the sensor device **25**.

The bar **30** is preferably arranged at a position in the front part of the vehicle, so that in the event of a collision, i.e., a deformation of the front part, it will be displaced longitudinally. This causes the yoke **29** to be brought out of engagement with the sensor device **25**.

FIG. **5** shows a further embodiment of the present invention, which comprises a pretensioning device **31** of the kind which is normally used to tighten a seat belt in the event of a collision. The pretensioning device **31** is fixed on the brake pedal arm **2** by means of a clamp **32** or the like.

Inside the pretensioning device **31**, a piston **33** is arranged, which piston is connected to a bar **34** or a wire, depending on the type of assembly. In the first case, the bar **34** is, in turn, connected to the plate **6** by means of an attachment **35**. Furthermore, inside the pretensioning device **31** a powder charge **36** is arranged, which charge can be ignited by means of a triggering device (not shown). In this case, the piston **33** will be caused to move upwards, thereby pulling the bar **34** upwards. This causes the plate **6** to rotate a certain amount in the counter-clockwise direction, thereby releasing the push bar **8** from the shaft **5**, as has been described above.

The pretensioning device **31** is connected to a sensor device **37** by means of a connector **38**. The sensor device **37** is preferably of a type which is used as an acceleration sensor which detects severe braking of the vehicle. Preferably, the invention uses the same kind of sensor which is utilized to trigger an airbag used in vehicles to protect the occupants. The sensor device **37** is preferably arranged inside the passenger compartment of the vehicle, for example in connection with the vehicle's gear lever.

FIG. **6** shows a simplified top view of a vehicle **39** in which the present invention can be used. The drawing shows an intended position for the engine **40** of the vehicle **39** and a zone **41** in the vehicle **39** within which the sensor device, being arranged to activate the release of the push bar from the brake pedal arm, can be arranged. The term "sensor device" refers to the second cylinder **14** with its corresponding rod **15** (according to the embodiment shown in FIGS. **1** and **2**) or the sensor device **25** with its yoke **29** (in the embodiment shown in FIGS. **3** and **4**). The sensor device **37** according to FIG. **5** can be placed anywhere in the vehicle since it is an acceleration sensor.

As regards the position of the zone **41**, it starts at a certain distance **1**, as seen from the front bumper of the vehicle **39**. This means that there will be a certain "delay" as regards the activation of the sensor device, i.e., from the instant that a collision takes place. This delay, which in the event of a collision corresponds to the time it takes until the deformation of the front part of the vehicle reaches the sensor, is normally approximately 20–40 ms, preferably approximately 30 ms. This corresponds to a distance 1_1 from the front edge of the vehicle **39** of approximately 30 cm. In a corresponding manner, the release of the brake pedal arm from the push rod must not take place too late. For this reason, the zone **41** is limited in the longitudinal direction of the vehicle **39** by a certain distance **1**, from the front edge of the vehicle **39**, which distance 1_2 is approximately 45 cm. Obviously, these distances, 1_1 and 1_2, can vary according to the size of the vehicle and the engine compartment—the example refers to a large family car.

A preferred position for a sensor device is shown with reference numeral **42** in FIG. **6**. A further possible position for the sensor device is shown with reference numeral **43**. The latter position is possible since the engine **40** then will constitute a rigid body, by means of which the zone **41** is extended in the longitudinal direction of the vehicle **39**. In this manner, the zone **41** can provide an effective extension a certain distance behind the engine **40**. Other rigid bodies in the engine compartment of the vehicle **39** which are positioned in front of the sensor device also function so as "extend" the limitation of the zone **41**.

Furthermore, the vehicle **39** should preferably be traveling with a predetermined minimum collision speed in order to allow the release of the brake pedal from the push bar. This speed is preferably 15 mph (24 km/h). This means that the sensor device and the vehicle must be arranged so that collisions at lower speeds than the above-mentioned limit will cause a deformation which does not reach the sensor device so that it triggers the release of the brake pedal arm.

The present invention is not limited to the described embodiments, but may be varied within the scope of the appended claims. For example, the edges **16** of the tongues **7** can be shaped in different ways, and can be curve-shaped, alternatively be slightly or highly oblique in relation to the plane of the plate **6**.

It should also be noted that although the present invention has been described in connection with a brake pedal, it can also be utilized in other kinds of pedals.

Furthermore, the sensor device which is used (i.e., the second cylinder **13** or the sensor device **25**) is preferably positioned so as to be triggered both in the event of a head-on collision and in the event of a so called "offset" collision, i.e., a collision where a vehicle collides so that its front part is somewhat displaced sideways in relation to its position in a head-on collision. In order for the sensor device to trigger in the event of an offset collision, it is normally necessary to position it at one of the front edges of the vehicle.

The first cylinder **10** (see FIG. **1**) can be arranged either on the brake pedal arm **2** or on the shaft **3** about which the brake pedal arm **2** can be pivoted.

The above-mentioned pedal arrangements shown in FIGS. **1–5**, which comprise means to release the push bar **8** from the pedal arm **2**, are only examples of such arrangements. Other similar pedal arrangements are possible within the scope of the present invention, for example an electrical solution where a solenoid is activated by a sensor and pushes the push rod away so as to release it from the pedal arm, or a pyrotechnical solution according to the SIPS principle, wherein an ignition device in the engine compartment, for example in front of the wheelhousing on the driver's side, triggers a pretensioning device via a fuse, so that the pretensioning device releases the push bar.

Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. Apparatus for activation of a safety device associated with a vehicle pedal in a vehicle including a front edge, an engine compartment, a pedal arm, a push rod connected to said pedal arm, and acting means for acting upon said push rod, said apparatus comprising an actuator for releasing said push rod from said pedal arm upon actuation thereof, a sensor for actuation of said actuator in response to detection of a condition of said vehicle corresponding to a collision, said sensor being disposed in a predetermined zone within said vehicle, said predetermined zone being defined by a first distance proximate to said front edge of said vehicle and a second distance distal from said front edge of said vehicle, said first and second distances being selected whereby said predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed and corresponding to a time delay between a minimum time delay corresponding to said first distance and a maximum time delay corresponding to said second distance for activation of said sensor after said deformation.

2. The apparatus of claim 1 wherein said vehicle includes at least one rigid body, and wherein at least one of said first and second distances is extended rearwardly in said vehicle by the intervening presence of said at least one rigid body.

3. The apparatus of claim 1 wherein said sensor comprises a hydraulic cylinder which mechanically detects said condition of said vehicle.

4. The apparatus of claim 1 wherein said sensor comprises a cable connected to said actuator, a spring member attached to said cable for biasing said cable into a first biased position in which said actuator is actuated, and a yoke element limiting movement of said cable towards said first biased position, whereby upon detection of said condition said yoke element is displaced from limiting said movement of said cable into said first biased position.

5. The apparatus of claim 1 including a shaft extending from said pedal arm, said push rod including at least one opposed surface and being mounted on said shaft, said actuator comprising a pivoting member pivotally mounted on said pedal arm, said actuation of said actuator by said sensor comprising pivoting of said pivoting member, said pivoting member including at least one cam surface for interacting with said at least one opposed surface of said push rod upon pivoting of said pivoting member so as to dismount said push rod from said shaft.

6. The apparatus of claim 5 wherein said pivoting member is pivotally mounted on said shaft, whereby said dismounting of said push rod from said shaft comprises axially displacing said push rod out of engagement with said shaft.

7. The apparatus of claim 5 wherein said at least one cam surface comprises a tongue-shaped member protruding substantially perpendicularly from said pivoting member.

8. A safety device for association with a vehicle pedal in a vehicle comprising a console, a pedal arm pivotally mounted with respect to said console, a push rod connected between said pedal arm and a control device for said pedal arm including at least one opposed surface, a shaft extending from said pedal arm, said push rod being pivotally mounted on said shaft, said safety device comprising a pivoting member pivotally mounted on said pedal arm, said pivoting member including at least one cam surface for interacting with said at least one opposed surface of said push rod upon pivoting of said pivoting member so as to dismount said push rod from said shaft, and an actuator for pivoting said pivoting member before any part of said engine compartment effects said push rod during a collision.

9. The safety device of claim 8 wherein said pivoting member is pivotally mounted on said shaft, whereby said dismounting of said push rod from said shaft comprises axially displacing said push rod out of engagement with said shaft.

10. The safety device of claim 9 wherein said at least one cam surface comprises a tongue-shaped member protruding substantially perpendicularly from said pivoting member.

11. The safety device of claim 8 including a sensor for actuation of said actuator in response to detection of a condition of said vehicle corresponding to said collision.

12. The safety device of claim 11 wherein said actuator includes a first hydraulic cylinder connected to said pivoting member, whereby said sensor causes said pivoting member to pivot in a predetermined direction in response to said detection of said condition.

13. The safety device of claim 12 wherein said sensor includes a second hydraulic cylinder connected to said first hydraulic cylinder for actuating said first hydraulic cylinder upon mechanical activation of said sensor.

14. The safety device of claim 11 wherein said sensor comprises a cable connected to said pivoting member whereby said cable is actuated by said detection of said condition by said sensor.

15. The safety device of claim 14 including a spring member attached to said cable for biasing said cable into a first biased position in which said actuator is actuated, and a yoke element limiting movement of said cable towards said first biased position, whereby upon detection of said position said yoke element is displaced from limiting said movement of said cable into said first biased position.

16. The safety device of claim 8 wherein said at least one cam surface obliquely extends from the plane of said pivoting member.

17. A vehicle including the safety device of claim 11 wherein said sensor is mounted in a predetermined zone within said vehicle defined by a first distance proximate to said front edge of said vehicle and a second distance distal from said front edge of said vehicle, said first and second distances being selected whereby said predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed.

18. A method for activation of a safety device associated with a vehicle pedal in a vehicle including a front edge, an engine compartment, a pedal arm, a push rod connected to said pedal arm and acting means for acting upon said push rod, said method comprising detecting a condition of said vehicle corresponding to a collision by means of a sensor, and releasing said push rod from said pedal arm in response to said detecting of said condition, said detecting of said condition including a time delay between said collision and said releasing of said push rod, said time delay being provided by disposing said sensor in a predetermined zone within said vehicle, said predetermined zone being defined by a first distance proximate to said front edge of said vehicle and a second distance distal from said front edge of said vehicle, said first and second distances being selected whereby said predetermined zone defines a location in which deformation occurs upon a collision at at least a predetermined speed and corresponds to said time delay being between a minimum time delay corresponding to said first distance and a maximum time delay corresponding to said second distance.

19. A method for activation of a safety device associated with a vehicle comprising a console, a pedal arm pivotally mounted with respect to said console, a push rod connected between said pedal arm and a control device for said pedal arm including at least one opposed surface, a shaft extending from said pedal arm, said push rod being pivotally mounted

on said shaft, said method comprising pivoting a pivoting member mounted on said pedal arm, said pivoting member including at least one cam surface for interacting with said at least one opposing surface of said push rod upon pivoting said pivoting member, and guiding said cam surface so as to dismount said push rod from said shaft before any part of said engine compartment effects said push rod during a collision.

* * * * *

United States Patent [19]

Reno

[11] **3,795,295**

[45] **Mar. 5, 1974**

[54] **DEVICE FOR PREDETERMINING INITIAL FREE PLAY IN CLUTCH ACTUATING MECHANISMS**

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[73] Assignee: **Ford Motor Company, Dearborn, Mich.**

[22] Filed: **Dec. 6, 1972**

[21] Appl. No.: **312,446**

[52] **U.S. Cl.** ..... **192/110 R**, 192/99 S, 74/512

[51] **Int. Cl.** **F16d 21/04**, G05g 1/14

[58] **Field of Search** ..... 192/70.26, 89, 98, 99 S, 192/110 R, 111 R; 75/512; 85/72

[56] **References Cited**

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Primary Examiner—Benjamin W. Wyche
Assistant Examiner—Lance W. Chandler
Attorney, Agent, or Firm—Keith L. Zerschling; Clifford L. Sadler

[57] **ABSTRACT**

This disclosure relates to clutches for motor vehicles, and more particularly to a clutch actuating system having means for establishing initial free play without using external gauges. A clutch in accordance with this invention may have a clutch pedal, a clutch release lever and a Bowden wire interconnecting the pedal and the lever. The tubular housing or sheath portion of the Bowden wire has one of its ends secured by a pair of jam nuts to the vehicle body adjacent to the clutch pedal. The other end of the sheath is secured to a stationary member adjacent the clutch release lever by a jan nut and a unique frangible jam nut. The frangible nut has a threaded nut portion and a frangible collar that extends axially from the threaded portion. During initial installation of the clutch actuating mechanism, the jam nuts are tightened to remove all slack in the system and to bring the release fingers of the pressure plate assembly into firm contact with the clutch release bearing. The jam nut that is paired with the frangible nut is tightened until pressure on the collar causes it to fracture and separate from the threaded portion. The gap between the two nuts left by the separated collar is closed by additional tightening of the regular nut. The collar of the special jam nut is dimensioned so that upon its fracture and tightening of the nut paired with it, a proper predetermined amount of initial free play is established in the system.

8 Claims, 4 Drawing Figures

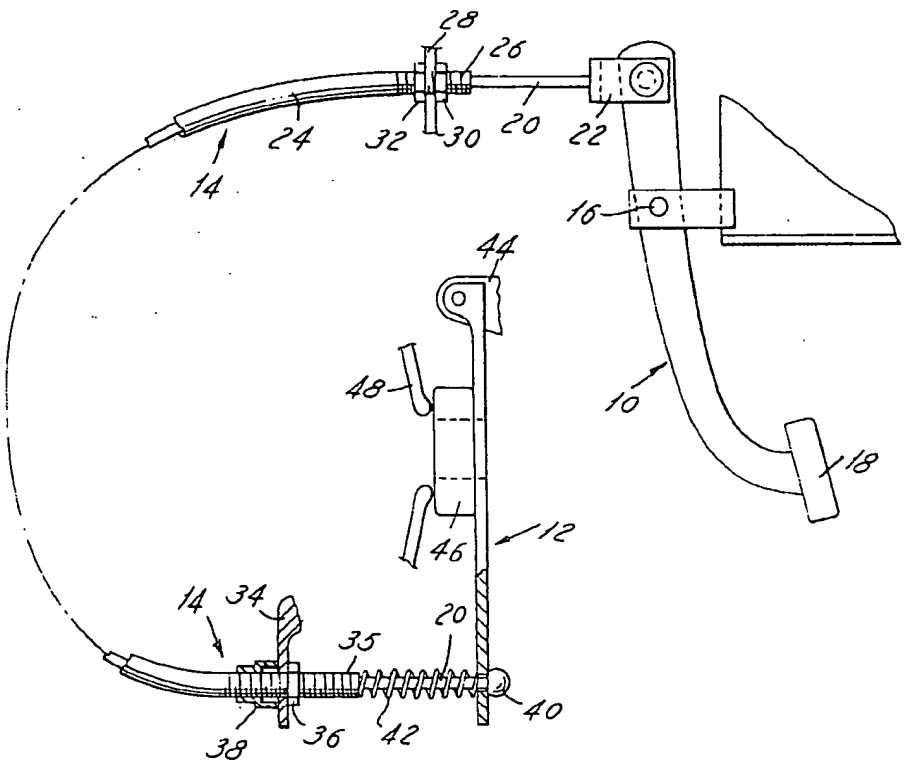


FIG. 1

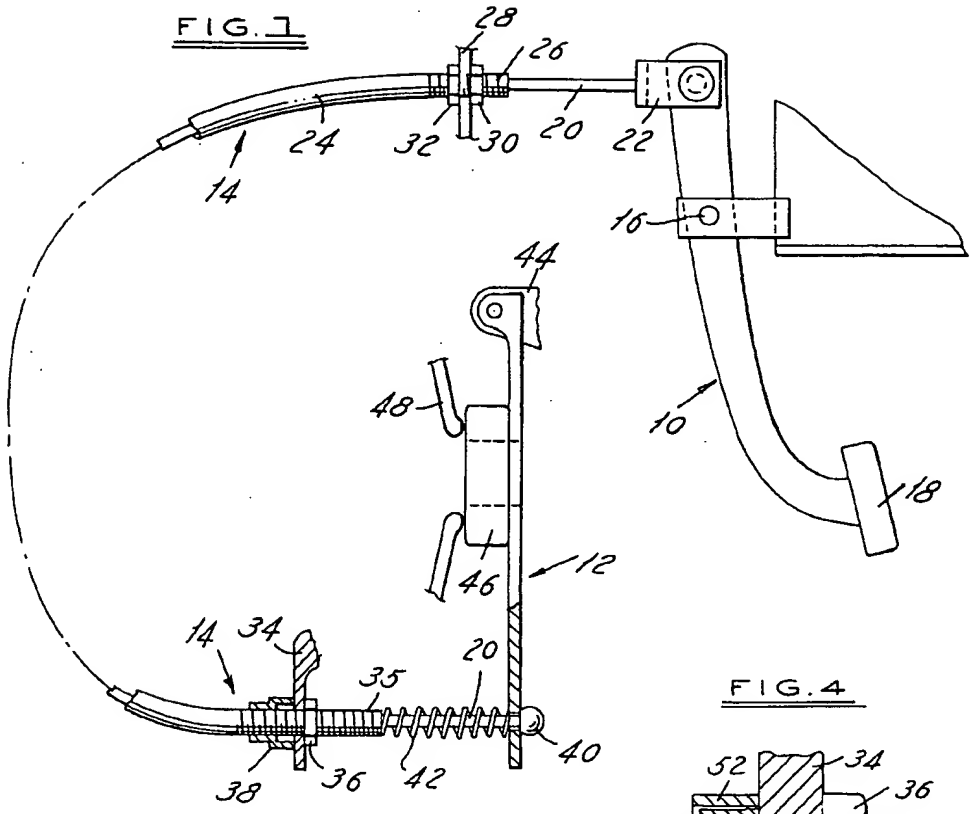


FIG. 4

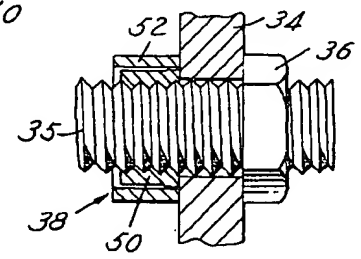


FIG. 3

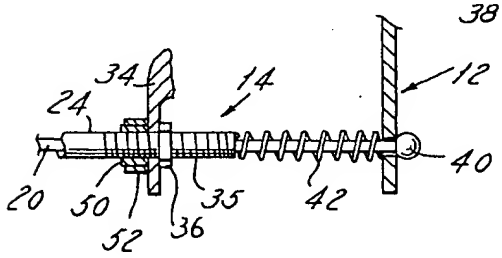
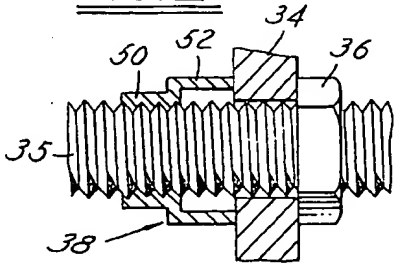


FIG. 2



DEVICE FOR PREDETERMINING INITIAL FREE PLAY IN CLUTCH ACTUATING MECHANISMS

BACKGROUND OF THE DISCLOSURE

The present invention relates to a Bowden wire type clutch actuating mechanism for a motor vehicle, and more particularly to a clutch actuating mechanism that is constructed to automatically establish an appropriate amount of initial free play without using external gauges.

In conventional clutch actuating systems employing Bowden wire actuators, it is common practice to establish free play by pulling the Bowden wire assembly until the clutch release bearing is in firm contact with the clutch release fingers of the pressure plate assembly. The jam nuts securing one end of the Bowden wire sheath are then backed off a desired amount and locked in position. The amount that the jam nuts are backed off determines the initial free play. In order to provide the proper level of free play, a gauge must be used to measure the distance which the nuts are backed off.

It is the principal ojbect of the present invention to provide a clutch actuating system of the Bowden wire type which automatically establishes the amount of initial free play without the use of external gauges.

BRIEF SUMMARY OF THE DISCLOSURE

In accordance with the presently preferred embodiment of this invention, a clutch actuating system is provided that permits initial clutch free play to be automatically established upon installation of the system without the use of external gauges.

In the preferred embodiment, a clutch pedal is connected to a clutch release lever by a Bowden wire assembly. The sheath portion of the Bowden wire has one end secured by a first pair of jam nuts to the vehicle body adjacent to the pedal. The other end of the Bowden sheath is connected to a chassis flange, such as flange connected to the flywheel housing, by a second pair of jam nuts. One of the jam nuts of the second pair is of special construction.

The special jam nut has a threaded portion and a frangible annular extension or collar. The threaded portion engages a threaded fitting on the end of the Bowden wire sheath. The special nut is of thin wall construction where the annular collar portion joins the threaded portion whereby when an axial force is applied to it that exceeds a predetermined minimum value, the annular collar will fracture and will separate from the threaded portion.

The Bowden wire is installed by connecting the flexible cable to the clutch pedal and to the clutch release lever. The first pair of jam nuts are used to secure one end of the sheath to the body adjacent to the clutch pedal. The second pair of jam nuts (including the special jam nut) connecting the other end of the sheath to the chassis flange are tightened to remove all slack in the system and to bring the release bearing into firm contact with the clutch release fingers. After the free play is removed, the regular jam nut of the second pair of nuts is tightened with a tool, thereby exerting a load on the annular collar or extension and causing it to fracture. After the annular collar has separated from the threaded portion, the regular nut of the second pair is tightened in a conventional manner to secure the sheath end to the flange of the flywheel housing.

The length of the frangible annular extension of the special jam nut automatically determines the amount of free play that will be established. By merely removing the slack in the system and then tightening a regular jam nut, appropriate free play is provided in the clutch actuating system without the use of external gauges.

BRIEF DESCRIPTION OF THE DRAWINGS

The many objects and advantages of a clutch actuating system constructed in accordance with this invention will become apparent upon consideration of the following detailed description and the accompanying drawings, in which:

FIG. 1 is a schematic view of a clutch actuating system embodying the present invention;

FIG. 2 is an enlarged elevational view, partly in section, of the special jam nut and the regular jam nut connecting one end of the Bowden wire sheath to a flange secured to the flywheel housing;

FIG. 3 is a view of a portion of the clutch actuating system after the free play adjustment has been made; and

FIG. 4 is an enlarged elevational view, partly in section, of the portion of FIG. 3 showing the attachment between the Bowden sheath and the flywheel housing flange.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein the presently preferred form of this invention is illustrated, FIG. 1 discloses a clutch actuating system that includes a clutch pedal **10**, a clutch release lever **12** and a Bowden wire **14** that operatively connects the pedal **10** with the release lever **12**.

The pedal **10** is pivotally supported at **16** upon vehicle body structure. The lower end of the pedal **10** is provided with a pedal pad **18** for engagement by a vehicle operator. The upper end of the pedal **10** is connected to a flexible cable **20**, which forms a portion of the Bowden wire **14**, by means of a clevis **22**.

The cable **20** is slidably supported by a sheath **24** that has a threaded fitting **26** connected to its upper end. The threaded fitting **26** of the Bowden wire assembly **14** is secured to a bracket member **28** by a pair of jam nuts **30** and **32**. The bracket **28** is mounted on vehicle body structure. The jam nuts **30, 32** threadedly engage the end fitting **26** and are disposed on either side of the body supported bracket **28**.

The lower end of the sheath **24** has a threaded fitting **35** that is secured to a flange element **34** of the flywheel housing by a pair of jam nuts. This second pair of jam nuts includes a regular nut **36** and a special nut **38**. The details of this structure and its function will be described below.

The lower end of the flexible cable **20** extends through an aperture in the outer end of the clutch release lever **12**. A ball-shape stop member **40**, rigidly affixed to the end of the cable **20** engages the lever **12**. A coil spring **42**, interposed between the end of the Bowden wire sheath **24** and the clutch release lever **12**, urges the lever **12** into engagement with the stop member **40**.

The clutch release lever is a lever of the second class with its upper end pivotally supported on a stationary

fulcrum member 44 of the clutch assembly. The release lever 12 engages a clutch release bearing 46 which, in turn, is constructed to engage fingers 48 of a clutch pressure plate assembly. The clutch assembly is spring pressed to a normally engaged condition. When the release lever 12 of FIG. 1 is rotated in a clockwise direction, the release bearing 46 causes the release fingers 48 to move in a direction which disengages the clutch.

In accordance with the present invention, means are provided for establishing an appropriate level of free play in the clutch upon initial installation of the clutch actuating system. The measn comprises a special jam nut 38 which has a threaded portion 50 that threadedly engages the threaded fitting 35 on the end of the sheath 24. An annular collar 52 is connected to the threaded portion 50 and forms an axial extension thereon. The collar 52 is of thin wall construction where it joins the threaded portion 50 so as to to be shearable therefrom when subjected to an axial force that exceeds a predetermined minimum.

OPERATION

In the illustrated embodiment, initial clutch free play is automatically established at the time the clutch actuating system is installed in the vehicle.

Installation of the system of FIG. 1 includes connecting the cable 20 of the Bowden wire 14 to the clutch pedal 10. The jam nuts 30 and 32 are then tightened so as to secure the threaded fitting 26 at the upper end of the Bowden wire sheath 24 to the body structure 28. The lower end of the cable wire 20 is then connected to the release lever 12. The regular jam nut 36 is backed off and the special jam nut 38 is tightened until all slack is removed from the system and the clutch release bearing 46 is brought into firm contact with the clutch release fingers 48.

The slack is removed from the actuating system by running the special jam nut 38 finger tight against the flange 34 of the flywheel housing. This action draws the cable 20 to the left and the release lever 12 in a clockwise direction until the bearing 46 contacts the clutch release fingers 48 as seen in FIG. 1.

After all free play is removed, the regular jam nut 36 is tightened with a wrench against the housing flange 34 whereby a force is exerted on the annular extension 52 of the special nut 38. This force causes the extension 52 to fracture. The regular nut 36 is then tightened to close the gap between threaded portion 50 of the nut 38 and the flywheel housing flange 34. The annular collar 52 is displaced to a position overlapping the regular threaded portion 50 and the nut 36 tightened to eliminate the space left by the collar as seen in FIGS. 3 and 4.

FIGS. 3 and 4 illustrate the relative position of the various components after the collar 52 has been fractured and the threaded fitting 35 extended by the tightening of nut 36. The axial length of the collar determines the initial free play in the system and automatically provides a predetermined amount of free play or clearance between the bearing 46 and the clutch release fingers 48 when the pedal 10 is in its clutch engaged position. The initial establishment of free play is accomplished without the use of an external gauge.

The foregoing description presents the presently preferred embodiment of this invention. Modifications and alterations may occur to those skilled in the art that will come within the scope and spirit of the following claims.

I claim:

1. An actuating mechanism having a first movable member, a second movable member and connecting means operatively interconnecting said first and second movable members;

support means supporting said connecting means;

a frangible means and a securing means connecting said support means to a support structure;

said frangible means and said securing means being adjustable to alter the position of said support means and said connecting means;

said frangible means having a frangible spacer portion engaging said support structure;

frangible portion being constructed to be fractured to alter the position of said connecting means relative to said support structure by a predetermined dimension.

2. An actuating mechanism having free play establishing means;

said actuating mechanism including a first movable member, a second movable member and connecting means operatively interconnecting said first and second members;

supporting means supporting said connecting means;

said supporting means having a threaded portion;

a support bracket;

a first nut and a second nut situated on either side of said support bracket and threadedly engaging said threaded portion of said supporting means;

said first nut having a threaded portion and a frangible extension;

said frangible portion engaging said bracket;

said first nut being constructed to be tightened to remove slack in said actuating mechanism;

said second nut being constructed to be tightened to exert a force on said first nut of sufficient magnitude to fracture said frangible extension whereby said threaded portion of said first nut and said second nut are engageable with said support bracket;

said frangible extension being of a length to establish the desired level of free play in said actuating mechanism when said second nut is tightened.

3. A motor vehicle clutch actuating mechanism having a clutch free play establishing means,

said clutch actuating mechanism including a clutch pedal, a clutch release lever and a flexible cable operatively interconnecting said pedal and said lever;

supporting means supporting said flexible cable;

said supporting means having a support portion,

a support bracket;

a first fastening means and a second fastening means engaging said support bracket and said support portion of said supporting means;

said first fastening means having a body portion engaging said support portion and a frangible extension engaging said support bracket;

said first fastening means being constructed to be adjusted to remove slack in said clutch actuating mechanism;

said second fastening means being constructed to be adjusted to exert a force on said first fastening means of sufficient magnitude to fracture said fran-

gible extension whereby said body portion of said first fastening means and said second fastening means are engageable with said support bracket;

said frangible extension being of a length to establish the desired level of free play in said clutch actuating mechanism when said second fastening means is full adjusted.

4. A motor vehicle clutch actuating mechanism according to claim 3 and including:

said supporting means comprising a flexible sheath having one of its ends rigidly supported on vehicle structure;

said flexible cable being slidably supported in said sheath.

5. A motor vehicle clutch actuating mechanism having a clutch free play establishing means;

said clutch actuating mechanism including a clutch pedal, a clutch release lever and a Bowden wire assembly operatively interconnecting said pedal and said lever;

a flexible Bowden wire sheath having one of its ends rigidly supported on vehicle structure;

a flexible Bowden cable slidably supported in said sheath and having one end connected to said pedal and its other end connected to said release lever:

the other end of said sheath having a threaded portion;

a support bracket;

a first jam nut and a second jam nut situated on either side of said support bracket and threadedly engaging said threaded portion of said sheath,

said first jam nut and a second jam nut situated on either side of said support bracket and threadedly engaging said threaded portion of said sheath,

said first jam nut having a threaded body portion engaging said threaded portion of said sheath and a frangible extension engaging said support bracket;

said first jam nut being constructed to be tightened to remove slack in said clutch actuating mechanism;

said second jam nut being constructed to be tightened to exert a force on said first jam nut of sufficient magnitude to fracture said frangible extension whereby said threaded body portion of said first jam nut and said second jam nut are engageable with said support bracket;

said annular extension being of a length to establish the desired level of free play in said clutch actuating mechanism when said second jam nut is tightened.

6. A motor vehicle clutch actuating mechanism according to claim 5 and including:

said frangible extension of said first jam nut comprising an axially extending annular portion.

7. A motor vehicle clutch actuating mechanism according to claim 5 and including:

said first jam jut including said threaded body portion, an annular extension, and a frangible connection between said threaded portion and said extension;

said annular extension being engageable with said support bracket.

8. A motor vehicle clutch actuating mechanism according to claim 5 and including:

said first jam nut including said threaded body portion, an annular extension and a frangible connection between said threaded body portion and said annular extension,

said annular extension having a greater interior dimension than the exterior dimension of said threaded body portion whereby said annular extension can fit over said threaded body portion when said frangible connection is fractured.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,795,295 Dated March 5, 1974

Inventor(s) Frederick Reno

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 24, change "ojbect" to -- object --;

line 41, after "as" insert -- a --.

Column 2, line 21, after "housing" insert -- prior to the free play adjustment --.

Signed and sealed this 11th day of March 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

United States Patent [19]

De Grazia

[11] **3,859,866**

[45] **Jan. 14, 1975**

[54] **CLUTCH ACTUATING MECHANISM**

[75] Inventor: **Victor S. De Grazia, Dearborn, Mich.**

[73] Assignee: **Ford Motor Company, Dearborn, Mich.**

[22] Filed: **Nov. 5, 1973**

[21] Appl. No.: **413,160**

[52] **U.S. Cl.** ..... **74/512, 74/501, 192/111 A**

[51] **Int. Cl.** **G05g 1/14**

[58] **Field of Search** ..... 74/512, 501; 192/111 A; 403/3, 4, 115

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Primary Examiner—Samuel Scott
Assistant Examiner—F. D. Shoemaker
Attorney, Agent, or Firm—Clifford L. Sadler; Keith L. Zerschling

[57] **ABSTRACT**

This disclosure relates to a clutch actuating system having means for establishing initial free play without using an external gauge. A clutch system in accordance with this invention may have a clutch pedal, a clutch release lever and a Bowden wire assembly interconnecting the pedal and the lever. The sheath portion of the Bowden wire has one of its ends secured to a bracket adjacent the clutch release lever. The other end of the sheath is secured to the vehicle fire wall adjacent the clutch pedal where an externally threaded fitting at the second end of the sheath fits within a tubular housing bolted to the fire wall. The end of the tubular housing has four angularly spaced apart slots in its end face. A special adjustment nut on the threaded fitting has four axially extending projections arranged to engage the tubular housing. During initial installation of the clutch actuating mechanism, the adjustment nut is rotated to remove slack in the Bowden wire. When the nut is tightened finger tight and no more slack remains in the Bowden wire assembly, the projections on the nut will engage the end of the tubular housing. The nut is then turned through a few degrees in either direction until the projections drop into the slots in the end of the tubular housing. The adjustment nut is then pulled into seated engagement with the end of the housing and held by a spring clip. The length of the projections provides and assures the appropriate amount of free play in the clutch actuating system.

7 Claims, 7 Drawing Figures

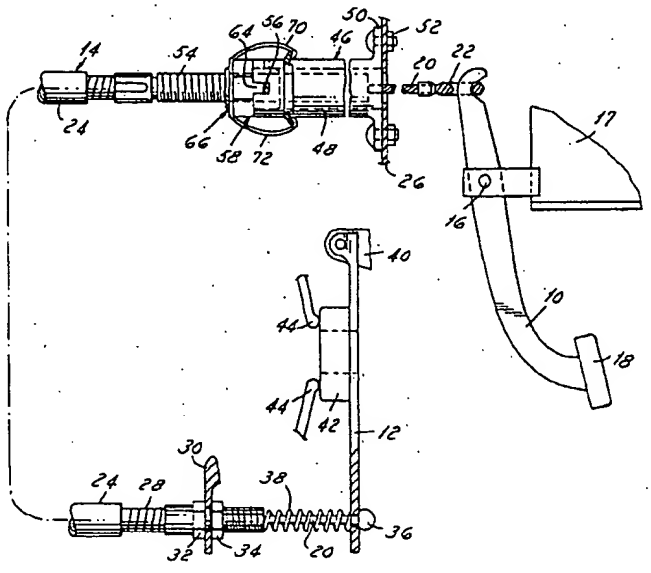


FIG. 1

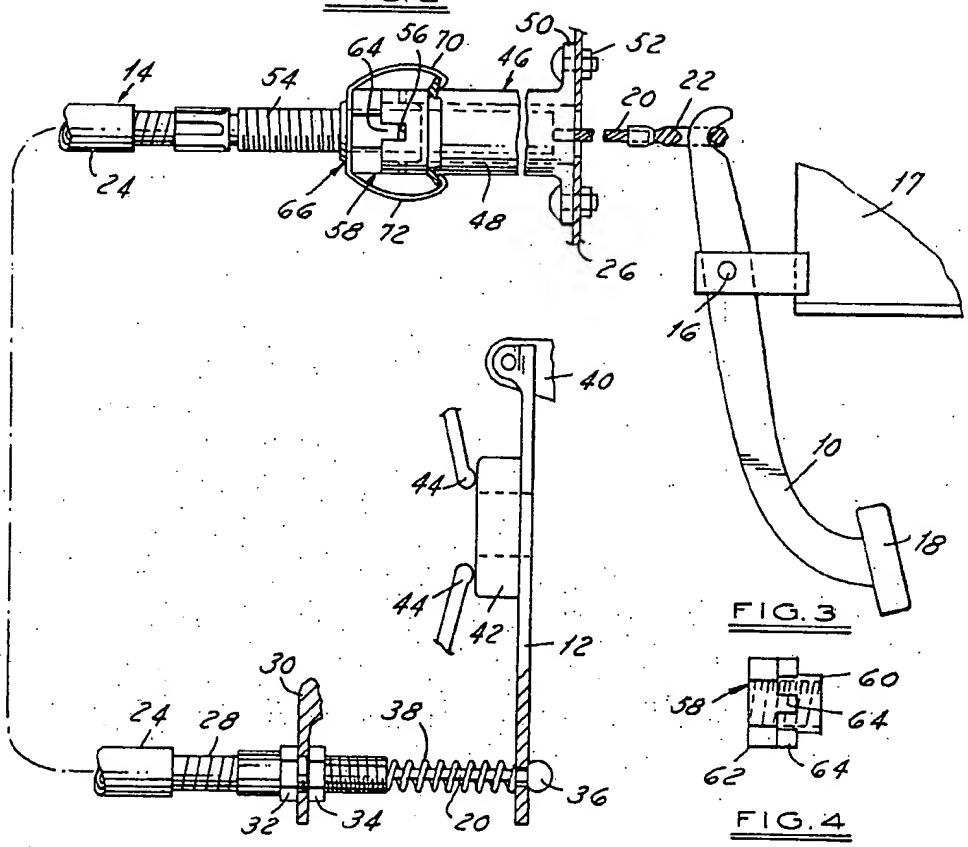


FIG. 2

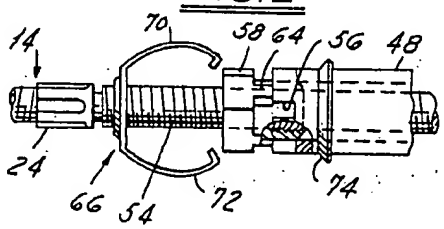


FIG. 3

FIG. 4

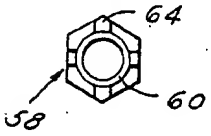


FIG. 5

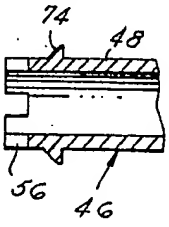


FIG. 6

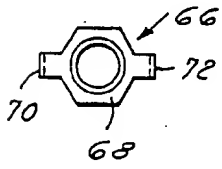
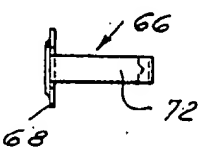


FIG. 7



CLUTCH ACTUATING MECHANISM

BACKGROUND OF THE DISCLOSURE

The present invention relates to a Bowden wire type clutch actuating mechanism for a motor vehicle and, more particularly, to a clutch actuating mechanism that is constructed to automatically establish an appropriate amount of initial free play without using an external gauge.

In conventional clutch actuating systems employing Bowden wire actuators, it is common practice to establish free play by applying a force to the Bowden wire assembly until the clutch release bearing is in firm contact with the clutch release fingers of the pressure plate assembly. The jam nut securing one end of the Bowden wire sheath is then backed off a desired amount and locked in position. The amount that the jam nut is backed off determines the free play. In order to provide the proper level of free play, a gauge must be used to measure the distance which the nut is backed off.

It is the principal object of the present invention to provide a clutch actuating system of the Bowden wire type that automatically establishes the amount of initial free play without the use of an external gauge.

BRIEF SUMMARY OF THE DISCLOSURE

In accordance with the presently preferred embodiment of this invention, a clutch actuating system is provided for a motor vehicle that permits initial free play to be automatically established upon installation of the system without the use of an external gauge.

In the presently preferred embodiment, the clutch pedal is connected to a clutch release lever by a Bowden wire assembly. The sheath portion of the Bowden wire has one end secured by a pair of jam nuts to a stationary bracket adjacent to the clutch release lever. The other end of the Bowden sheath has an externally threaded end fitting that fits within a tubular housing member rigidly secured to the vehicle's fire wall. The forwardly facing end of the tubular housing has four angularly spaced apart slots. A specially constructed adjustment nut is threadedly received on the end fitting of the sheath and has a pilot portion extending into the tubular housing. The nut has four spaced projections that extend in a rearward direction.

The Bowden wire assembly is installed in the motor vehicle by connecting the flexible cable to the clutch pedal and to the clutch release lever. The pair of jam nuts are used to secure one end of the sheath to the stationary bracket adjacent the clutch release lever. The threaded fitting at the other end of the sheath is positioned within the tubular housing. The adjustment nut is tightened by hand to remove all slack in the system and to bring the clutch release lever into firm contact with the clutch release bearing. With all free play removed from the system, the projections on the nut will be in engagement with the end of the tubular housing. The adjustment nut is then rotated through a few degrees until the projections drop into the slots on the end of the housing. This will permit displacement of the sheath by an amount equal to the length of the projections. A special spring clip is then used to hold the nut in firm contact with the tubular housing.

This arrangement will automatically provide the desired amount of initial free play in the clutch system. The free play will be determined by the length of the projections on the adjustment nut. By merely removing the slack in the system and then seating the nut in proper engagement with the end of the housing, appropriate free play is provided in the clutch actuating system without the use of an external gauge.

BRIEF DESCRIPTION OF THE DRAWINGS

The many objects and advantages of a clutch actuating system constructed in accordance with this invention will become apparent upon consideration of the following detailed description and the accompanying drawings, in which:

FIG. 1 is a schematic view of a clutch actuating system embodying the present invention;

FIG. 2 is a view of the adjustment end of the Bowden wire assembly of FIG. 1 prior to adjustment;

FIG. 3 is a side elevational view, partly in section, of the adjustment nut;

FIG. 4 is an end view of the adjustment nut of FIG. 3;

FIG. 5 is an elevational view, partly in section, of the end of the tubular support housing;

FIG. 6 is an end view of the spring clip constructed to hold the adjustment nut in engagement with the tubular housing; and

FIG. 7 is a side view of the spring clip.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein the presently preferred form of this invention is illustrated, FIG. 1 discloses a clutch actuating system that includes a clutch pedal **10**, a clutch release lever **12** and a Bowden wire assembly **14** that operatively interconnects the pedal **10** with the release lever **12**.

The pedal **10** is pivotally supported at **16** upon vehicle body structure **17**. The lower end of the pedal **10** is provided with a pedal pad **18** for engagement by a vehicle operator. The upper end of the pedal **10** is connected by means of a clevis **22** to a flexible cable **20** which forms a portion of the Bowden wire assembly **14**.

The flexible cable **20** is slidably supported in a flexible sheath **24**. The upper end of the sheath is secured to the fire wall **26** of the vehicle by means which will be described below. The lower end of the sheath **24** has a threaded portion **28** that extends through an aperture in a support bracket **30**. The bracket **30** is situated in proximity to the clutch release lever **12**. A pair of threaded jam nuts **32** and **34** are situated on either side of the bracket **30** and secure the threaded end **28** of the sheath **24** to the bracket.

The lower end of the flexible cable **20** extends from the end **28** of the sheath **24** and through an aperture in the end of the clutch release lever **12**. A ball shape stop member **36** is affixed to the end of the cable **12**. A coil spring **38** is interposed between the end of the threaded portion **28** and the lever **12**. The spring **38** urges the lever **12** into engagement with the stop **36**.

The clutch release lever **12** is a lever of the second class with its upper end pivotally supported on a stationary fulcrum member **40** of the clutch assembly. The clutch release lever **12** engages a clutch release bearing **42** which, in turn, is constructed to engage fingers **44** of a clutch pressure plate assembly. The clutch assembly is spring pressed to a normally engaged condition. When the release lever **12** is pivoted in a clockwise direction (as seen in FIG. 1), the release bearing **24**

causes the release fingers 44 to move in a direction that disengages the clutch.

In order to provide a proper level of free play in the clutch assembly, the present invention provides a means for establishing initial free play upon installation of the Bowden wire assembly 14 without the use of an external gauge.

A support housing 46 having a tubular body portion 48 and a flanged rearward end 50 is secured to the fire wall 26 by means of bolts 52. The upper end of the sheath 24 has a threaded fitting 54 secured thereto. The tubular portion 48 of the housing 46 surrounds the flexible cable 20 and the threaded fitting 54 of the sheath. As seen in FIG. 5, the forward end of the tubular housing portion 48 is provided with four slots or notches 56 that are spaced 90° apart.

A specially constructed adjustment nut 58 is threadedly received on the threaded fitting 54. The nut 58 has a pilot portion 60 that is arranged to extend into the interior of the tubular portion 48 of the housing 46. The nut 58 has a hexagonal head 62 and a series of four spaced apart projections 64 that extend in a rearward direction.

OPERATION

In operation, the Bowden wire assembly 14 is installed in a vehicle by securing the ends of the cable 20 to the clutch pedal 10 and the clutch release lever 12. The lower end of the sheath 24 is rigidly secured to the bracket 30 by tightening the jam nuts 32 and 34.

In order to provide the proper amount of initial free play in the clutch actuating system, the special adjustment nut 58 is threaded on the threaded fitting 54 in a direction bringing it into engagement with the end of the tubular portion 48 of the housing 46. The nut 58 is tightened by hand until all slack is removed from the system and the projections 64 bear against the end of the tubular portion 48. The nut 58 is tightened to the extent necessary to bring the release bearing 42 into contact with the release fingers 44. At this point, all free play in the clutch actuating system has been removed. The nut 58 will be oriented with respect to the end of the tubular housing 48 as shown in FIG. 2.

In order to complete the installation, the adjustment nut 58 is rotated through a few degrees until the projections 64 align with the slots 56 in the tubular portion 48. The nut 58 is then moved to a seated position as shown in FIG. 1. Due to the interengagement between the projections 64 and the slots 56, the nut 58 and sheath 24 are able to move through a distance equal to the length of the projections 64 when the nut 58 is seated.

A spring clip 66 is provided to hold the nut 58 against the end of the housing 46 during normal operation of the vehicle. The clip 66 has an annular base portion 68 that surrounds the threaded fitting 54. The clip 66 also has a pair of arcuate spring arms 70 and 72 that terminate in hook shape ends.

When the nut 58 is moved to the seated position against the end of the tubular housing 48 as shown in FIG. 1, the spring clip 66 is drawn up against the nut 58. The hook shape ends of the spring arms 70 and 72 are then brought into cooperative engagement with an annular flange 74 formed on the exterior of the tubular housing portion 48. The spring clip 66 is thus constructed to hold the nut 58 in engagement with the slotted end of the tubular housing portion 48.

Thus, the axial length of the projections 64 determines the amount of free play in the system when the adjustment nut 58 is moved from its FIG. 2 position where no free play is present to its FIG. 1 position where the predetermined level of free play is provided.

The foregoing description presents the presently preferred embodiment of this invention. Modifications and alterations may occur to those skilled in the art that will come within the scope and spirit of the following claims.

I claim:

1. An actuating mechanism having a first movable member, a second movable member and connecting means operatively interconnecting said first and second movable members;

support means supporting said connecting means;

a stationary support structure;

adjustment means constructed to connect said support means to said support structure;

said adjustment means including an adjustment element connected to said support means;

said adjustment element having an axially extending gauge portion;

said support structure having a gauge receiving portion;

said adjustment element being displaceable from a first position wherein said gauge portion engages said support structure and is spaced apart from said gauge receiving portion to a second position wherein said gauge portion is seated in said gauge receiving portion;

retaining means constructed to hold said adjustment element in engagement with said support structure when said gauge portion is seated in said gauge receiving portion.

2. An actuating mechanism according to claim 1 and including:

said retaining means comprising resilient means engageable with both said adjustment element and said support structure.

3. An actuating mechanism having a first movable member, a second movable member and connecting means operatively interconnecting said first and second movable members;

support means supporting said connecting means;

said support means having a threaded portion;

a support structure having a bore coaxially arranged relative to said threaded portion;

a nut threadedly engaging said threaded portion of said support means;

said nut having an axially extending gauge portion;

said support structure having a gauge receiving portion;

said nut being displaceable from a first position wherein said gauge portion engages the end of said support structure and said gauge portion is angularly spaced from said gauge receiving portion to a second position wherein said gauge portion is seated in said gauge receiving portion;

means constructed to hold said nut in engagement with said support structure when said gauge portion is seated in said gauge receiving portion.

4. An actuating mechanism according to claim 3 and including:

said retaining means comprising a spring clip engageable with both said nut and said support structure.

5. An actuating mechanism having a first movable member, a second movable member and connecting means operatively interconnecting said first and second movable members;

support means supporting said connecting means;

said support means having a threaded portion;

a support structure having a tubular portion surrounding said threaded portion;

a nut threadedly engaging said threaded portion of said support means;

said nut having a pilot portion situated within said tubular portion;

said nut having an axially extending gauge portion;

said support structure having a gauge receiving portion;

said nut being displaceable from a first position wherein said gauge portion engages the end of said support structure and said gauge portion is angularly spaced from said gauge receiving portion to a second position wherein said gauge portion is seated in said gauge receiving portion;

resilient retaining means constructed to resiliently urge said nut into engagement with said support structure when said gauge portion is seated in said gauge receiving portion.

6. An actuating mechanism having a first movable member, a second movable member and motion transmitting means operatively interconnecting said first and second movable members;

support means supporting said connecting means;

a stationary support structure;

adjustment means constructed to connect said support means to said support structure;

said adjustment means including an adjustment element connected to said support means;

said adjustment element having an axially extending gauge portion;

said support structure having a gauge receiving portion;

said adjustment element being displaceable from a first position wherein said gauge portion engages said support structure and is spaced apart from said gauge receiving portion to a second position wherein said gauge portion is seated in said gauge receiving portion;

retaining means constructed to hold said adjustment element in engagement with said support structure when said gauge portion is seated in said gauge receiving portion.

7. An actuating mechanism according to claim 6 and including:

said retaining means comprising a spring engageable with both said adjustment element and said support structure.

* * * * *

United States Patent [19]

Fischer

[11] **4,106,601**

[45] **Aug. 15, 1978**

[54] **CONTROL DEVICE**

[75] Inventor: **Walter Fischer, Melle, Fed. Rep. of Germany**

[73] Assignee: **WF "Rational" Anbaükuchen Walter Fischerriemsloh, Melle, Fed. Rep. of Germany**

[21] Appl. No.: **783,932**

[22] Filed: **Apr. 4, 1977**

[51] **Int. Cl.²** **F16D 67/00**

[52] **U.S. Cl.** ..... **192/3 S; 74/512**

[58] **Field of Search** ..... 192/3 R, 3 S, 1; 74/512, 471 R

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Primary Examiner—Edgar W. Geoghegan

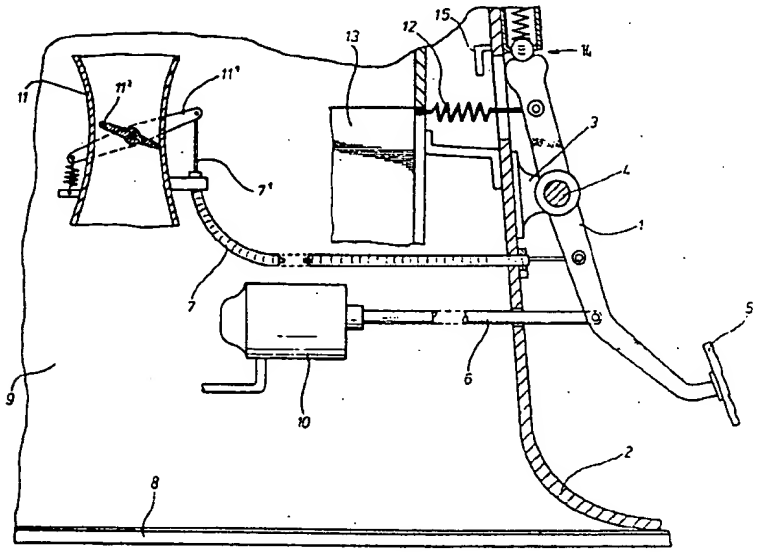
Attorney, Agent, or Firm—William Anthony Drucker

[57] **ABSTRACT**

A mechanism for control of fuel feed, and for the application of the brakes of motor vehicles with manual or automatic gear change.

A single spring-loaded foot pedal, held in idling position, is connected to fuel feed and to brake mechanism. When pressure on it is released the fuel feed is opened continuously, and when it is depressed completely the fuel feed is throttled down to idling. When it is depressed beyong idling position, the brakes are operated, and when it is released, the brakes are released.

5 Claims, 4 Drawing Figures



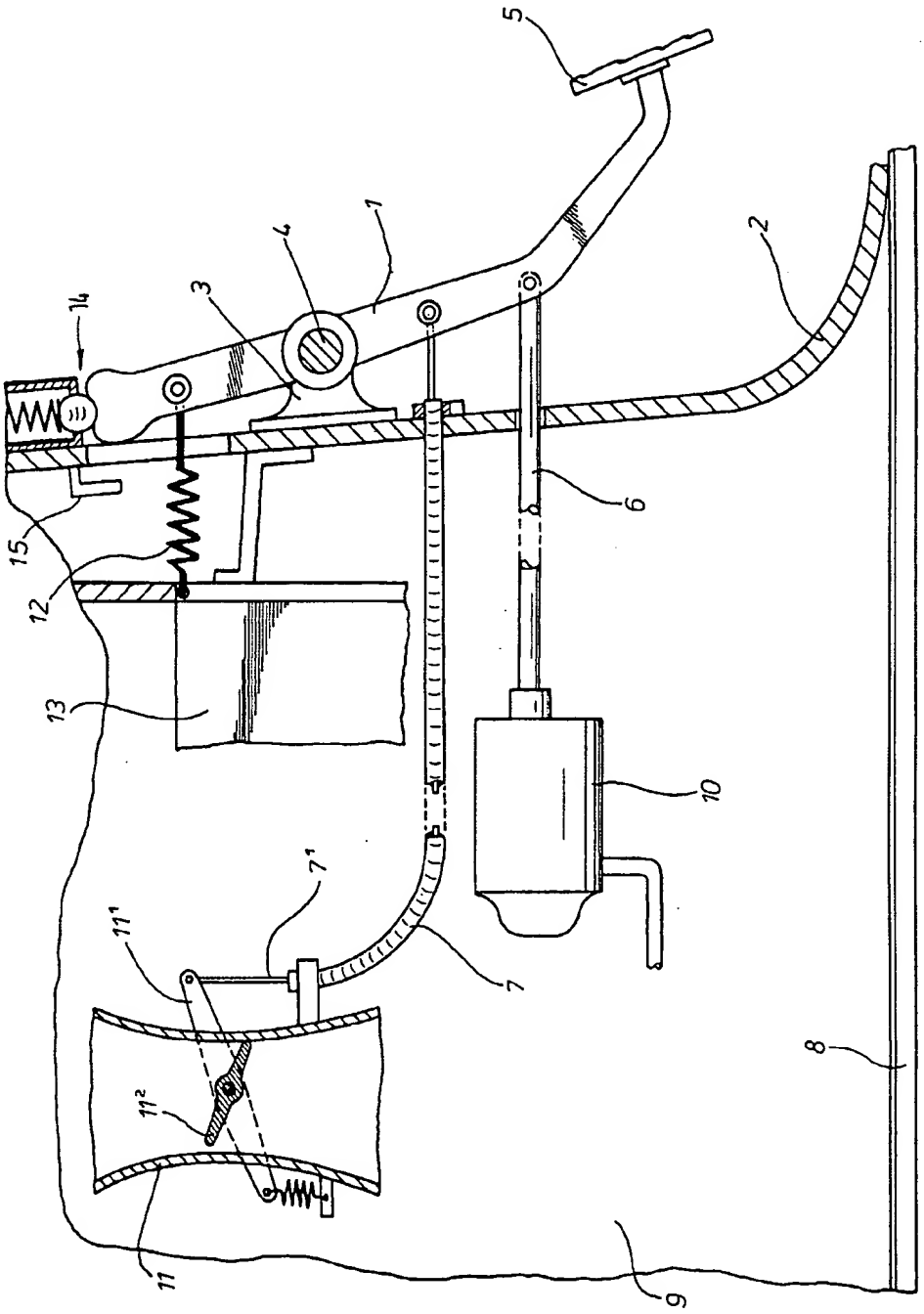


Fig. 1

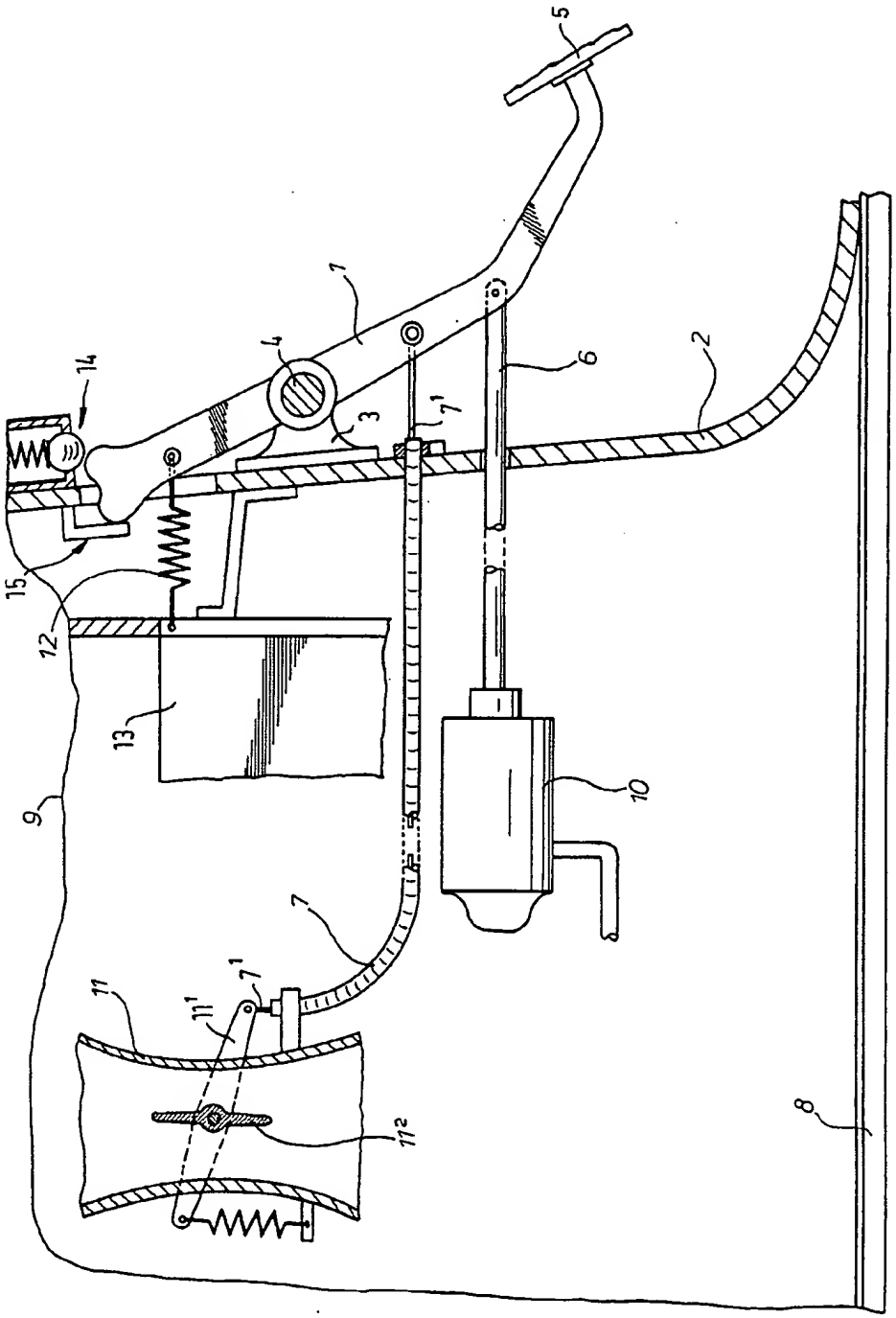


Fig. 2

Fig.3

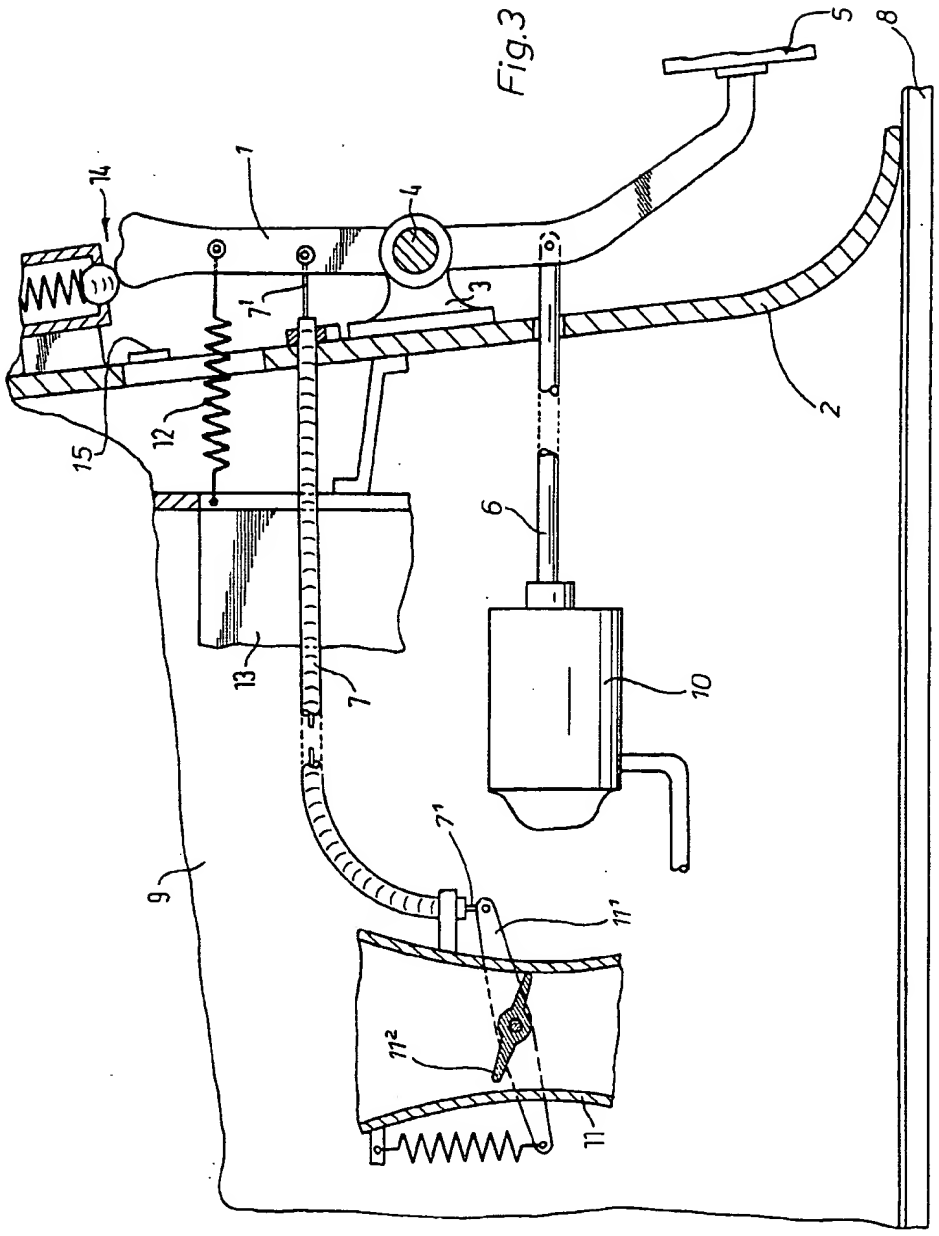
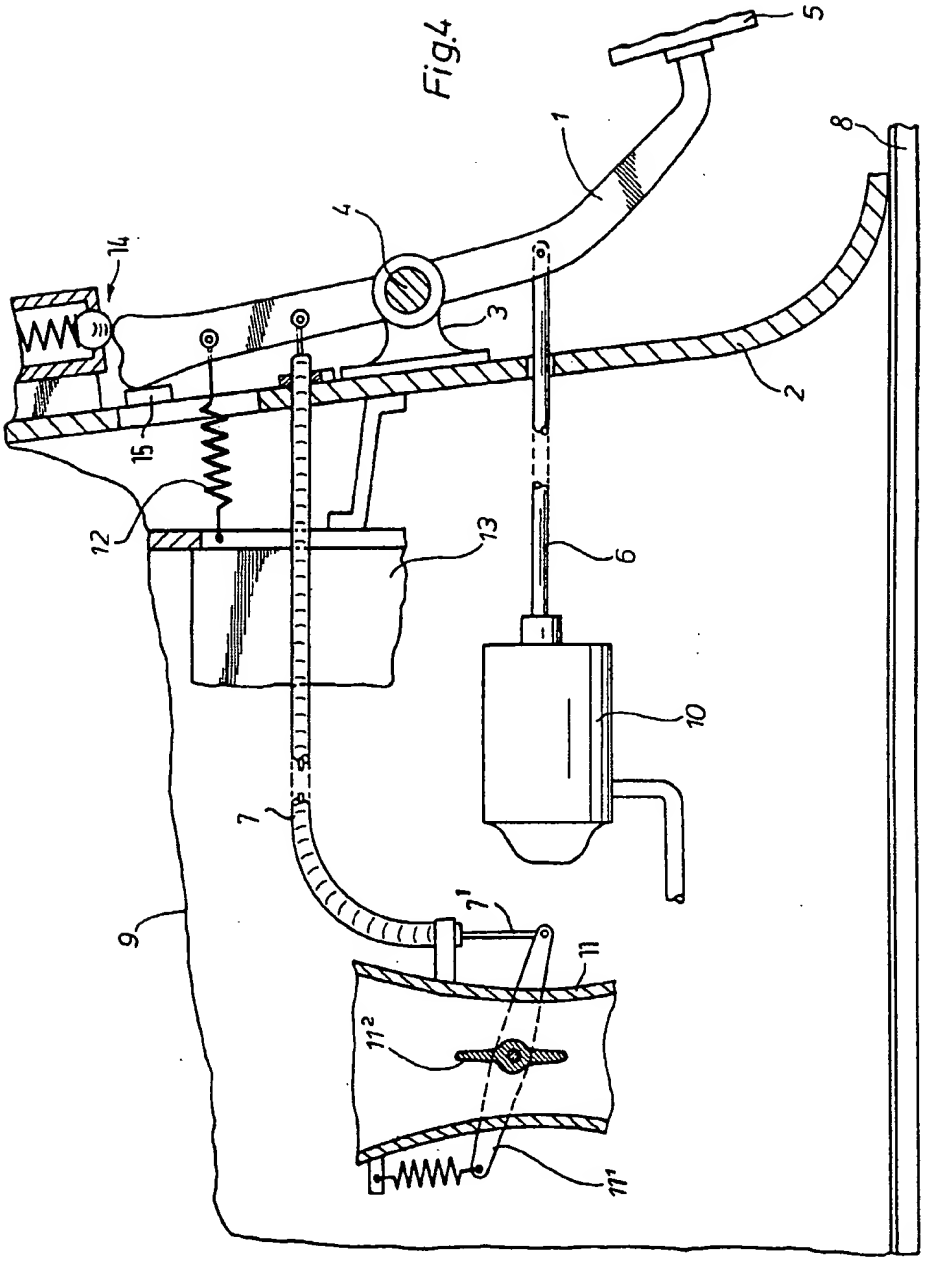


Fig.4



CONTROL DEVICE

The Invention refers to a device for the control of the fuel feed as well as for the operation of the brakes in front and rear engine driven vehicles with manual or automatic gear boxes.

It is common practice to use separate foot pedals for speed control and for the application of the brakes, these pedals being mounted next to each other on the vehicle frame and having to be pressed down for the initiation of an acceleration or braking process.

The pedal types known show shortcomings which can result in serious consequences, such as e.g. accidents through cars driving into the back of others. This applies to front or rear engine driven motor vehicles with manual or automatic gear boxes.

Since the same foot of the driver has to alternately depress the accelerator pedal and the brake pedal, time is lost if — for the purpose of braking — the foot first has to be taken off the accelerator pedal and placed on the adjacent brake pedal. In sudden danger situations, considerable time delays can occur in the operation of the pedal caused by reactions of shock. Many accidents can be attributed to the fact that in the event of fast driving, the driver's time of reaction does not suffice for a fast and safe operation of the brakes in the event of danger. It may even be possible that the driver, in a situation of shock, unwittingly omits a pedal change for the initiation of a braking process and, instead of applying the brakes, fully opens the fuel feed and accelerates his vehicle, since the human body — in particular arms and legs — tends to straighten in situations of shock. The vehicle is then steered into the danger zone at increased speed.

A further disadvantage of known pedal types and mountings lies in the fact that on a slope, starting is not possible without using the handbrake, since the adjacent pedals cannot be operated by one foot at the same time. During long continuous fast driving it is tiring for the driver if he has to keep one foot continuously on the accelerator pedal. In this case, only the foot assigned to the clutch pedal can be moved freely.

In contrast to the right foot which has to initiate two separate functions (acceleration and braking), the left foot only has to operate the clutch. This may not apply if the motor vehicle is equipped with fully automatic gear box without a clutch pedal. This type of vehicle offers itself for leg-amputated drivers. On the other hand, no suitable solutions have become known for a simple and safe operation of the pedals used for fuel feed and brake application.

It is the aim of the Invention to provide a device for motor vehicles for the control of the fuel feed and for the application of the brakes, a device which is designed and constructed in such a way that, in a simple, safe and fast manner without the basic position of the foot having to be changed, a braking process and an independent acceleration process can be initiated with one foot, with the change between acceleration and braking taking place in the shortest possible time.

According to the Invention, this aim is achieved by a single spring-pressure foot lever in form of a pedal in arrested idling position, this pedal being connected via transmission means both to the fuel feed as well as to the braking mechanism, i.e. in such a way that the fuel feed is opened continuously when the pressure on the pedal is released from the idling position, and the fuel feed is throttled to the idling position when the pedal is depressed, and that in the event of the pedal being depressed beyond the idling position, the braking mechanism is put into continuous operation and in the event of the pressure on the pedal being released, the braking mechanism is put out of action.

It is furthermore intended that these transmission means arranged between pedal and fuel feed be designed as transmission shafts, toggle joints, gear wheels, chain drives or belts.

The transmission means arranged between pedal and braking mechanism are preferably designed in the form of transmission shafts, toggle joints, gear wheels or chain drives.

A further feature of the Invention is the arrest of the pedal in the idling position, this being developed in form of a ball notch, a spring catch or a ratchet.

It should finally be mentioned that the spring connected with the pedal is designed as a looped spring, a coil spring or a spiral spring.

The following description is to further explain the Invention, with embodiments of the Invention being illustrated in the drawings, of which:

FIG. 1 shows a pedal mechanism for fuel feed control and brake operation on a motor vehicle, in the idling position;

FIG. 2 shows the pedal mechanism as per FIG. 1 in the position of maximum fuel feed;

FIG. 3 shows another pedal mechanism in the position of smallest fuel feed and braking;

FIG. 4 shows the pedal mechanism as per FIG. 3 in the position of maximum fuel feed.

According to FIG. 1, the mechanism comprises a foot lever in form of a pedal 1, which is mounted in the driver's foot area on the bottom plate 2 of the vehicle and is pivoted in a supporting frame 3 by means of a trunnion 4. At the lower end of the pedal, 1, a foot plate 5 is arranged for contacting by the driver's foot when braking.

The pedal 1 controls both the fuel feed (carburettor 11) as well as the brake mechanism (brake cylinder 10). The pedal arm of pedal 1 connected with the foot plate 5, is flexibly connected with the transmission shaft 6 and with a Bowden cable 7^1 running through a protective pipe 7. Transmission shaft 6 and Bowden cable 7^1 are conducted through the vehicle bottom plate 2 into the engine area bound by the chassis 8 and laterally by the vechicle body 9, whereby the transmission shaft 6 is connected with the plunger of brake cylinder 10 for the application of the brakes which are not shown, and whereby the Bowden cable 7^1 is connected for the fuel feed control to a spring-loaded adjusting lever 11^1 on the Carburettor 11 for the throttle valve 11^2.

At the other pedal lever arm, a tension spring 12 is acting, which continuously tries to turn the pedal 1 against the forward drive direction of the vehicle towards the direction of maximum fuel feed (FIG. 2). On the other side, the tension spring 12 is removably attached to an extension piece 13 connected to the body wall 9 and the vehicle bottom plate 2.

In accordance with FIG. 1, the pedal 1 is in the arrested idling position without the brake having been applied. A ball notch 14 — whose spring-loaded stop ball falls into a stop notch at the pedal lever end — above the pedal lever end connected with the tension spring 12 is intended for releasably retaining the pedal 1 in this position. A light touch of the pedal 1 in the forward driving direction releases the pedal 1.

With the driving motor in the idling position, the throttle valve 11^2 almost completely seals the Venturi tube of the Carburettor 11 and thus throttles the fuel feed to the fuel minimum required for idling. The brake cylinder 10 of the brake mechanism, too, is still out of action in this position so that the brakes are not being applied. A braking operation does not occur until the pedal 1 is depressed beyond the idling position (FIG. 3). This results in the brake cylinder 10 being put into continuous operation. When the pressure on pedal 1 is released, the brake mechanism is again put out of operation.

FIG. 2 and FIG. 4 show the pedal 1, after release of the arrest, in the position of maximum fuel feed, with the throttle valve 11^2 being completely open and the fuel feed being set to fuel maximum. This pedal position is limited through a projection 15 on the vehicle floor plate 2. A swing of pedal 1 beyond this full-throttle position is not possible.

By releasing the pressure on the pedal 1 from the idling position (FIG. 1), the fuel feed is opened continuously up to full throttle position whilst, when depressing the pedal against the force of the tension spring 12, the fuel feed is throttled to the idling position and the brakes are being applied continuously.

According to a further embodiment of the Invention (FIGS. 3 and 4), the transmission shaft 6 and the Bowden cable 7^1 are mounted on two separate pedal lever arms of pedal 1. The Bowden cable 7^1 is connected to that pedal arm which also carries the tension spring 12. The stop 15 prevents a swing of the pedal 1 beyond the full throttle position (FIG. 4), whilst the position of pedal 1 — for idling — can be arrested via the ball notch 14. This can take place no matter whether the vehicle is stationary or moving. Here too, a slight touching of pedal 1 releases the arrest.

The exemplified embodiments are designed for a front engine driven motor vehicle with suspended foot pedal. With a different mounting, the pedal can also be used in rear-engine driven motor vehicles with manual or automatic gear boxes. The Bowden cable 7^1 arranged between the fuel feed (carburettor 11) and the pedal 1 as a means of transmission of the pedal movement, could also be developed as a toggle joint, gear drive or chain drive. This also applies to the transmission means for the brake mechanism.

It is also possible to use a looped or a coil spring instead of the tension spring 12 for moving the pedal 1, whereby the use of a ratchet, an eccentric or a spring catch is also suitable for retaining the pedal 1 in the idling position.

The main advantage of the Invention can be seen in that the original basic foot position can be maintained both for the acceleration of the vehicle (opening up of engine) as well as for applying the brakes. This results in a reduction by half or more than half of the time of reaction required from the moment of recognising a possible danger to the application of the brakes.

Without having to change over the foot, the brakes can be applied instantly from the basic position whereby, for the braking process, the force of the foot can be transferred without any delay to the sole pedal. The chance of the foot assuming an inclined position during the braking process, which would mean a considerable loss of force, is eliminated by the mechanism of the Invention.

I claim:

1. Mechanism, for the control of the fuel feed and for the application of the brakes of front or rear engine driven motor vehicles with manual or automatic gear boxes, comprising a single spring-loaded foot lever in form of a pedal in arrested idling position, said pedal being connected via transmission means both to a fuel feed and to a brake mechanism such that, when the pressure on the pedal is released from the idling position, the fuel feed is opened continuously, and such that when the pedal is depressed completely, the fuel feed is throttled to the idling position, and such that when the pedal is depressed beyond the idling position, the brake mechanism is put into continuous operation, and such that when the pressure on the pedal is released, the brake mechanism is put out of operation.

2. Mechanism, as claimed in claim 1, wherein the transmission arranged between pedal and fuel feed is a transmission shaft, toggle joint, gear drive, chain drive or belt.

3. Mechanism, as claimed in claim 1, wherein the transmission means arranged between pedal and brake mechanism is a transmission shaft, toggle joint, gear drive or chain drive.

4. Mechanism, as claimed in claim 1, wherein the arrest of the pedal in the idling position is obtained by a ball notch, spring catch, ratchet or eccentric.

5. Mechanism, as claimed in claim 1, wherein the spring connected to the pedal is a looped, coil or spiral spring.

* * * * *

United States Patent [19]

Prohaska et al.

[11] **4,224,832**

[45] **Sep. 30, 1980**

[54] **ELECTROMOTIVE POWER BRAKE**

[75] Inventors: **Hans Prohaska, Bietigheim-Bissingen; Karl-Heinz Theurer, Marbach, both of Fed. Rep. of Germany**

[73] Assignee: **ITT Industries, Inc., New York, N.Y.**

[21] Appl. No.: **961,421**

[22] Filed: **Nov. 16, 1978**

[30] **Foreign Application Priority Data**

Dec. 29, 1977 [DE] Fed. Rep. of Germany 2758644

[51] **Int. Cl.**[2] **F16H 35/00**

[52] **U.S. Cl.** ..... **74/388 R; 60/545; 74/512; 303/3**

[58] **Field of Search** 74/388, 203, 207, 208, 74/512, 516, 625; 188/355, 360; 60/545; 303/3

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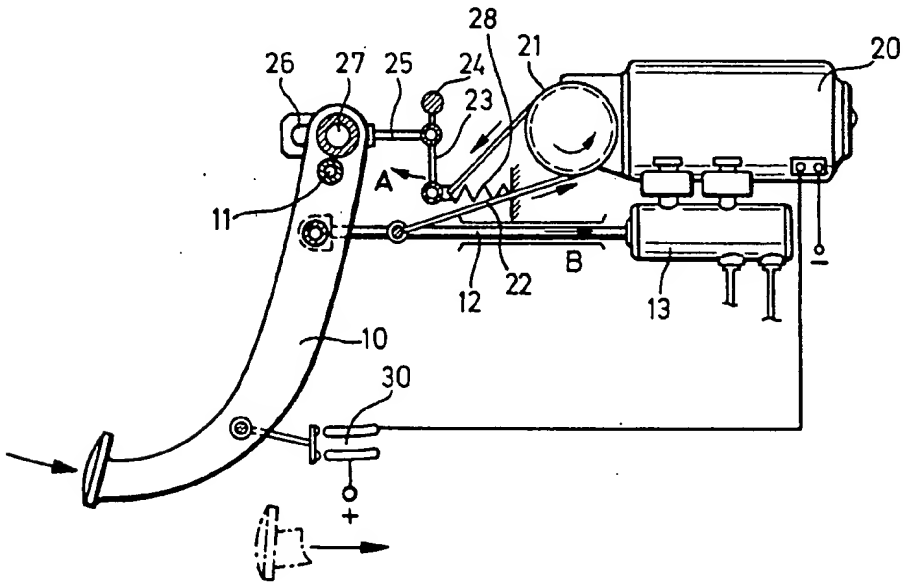
Primary Examiner—C. J. Husar
Assistant Examiner—Conrad Berman
Attorney, Agent, or Firm—John T. O'Halloran; Alfred C. Hill

[57] **ABSTRACT**

The power brake includes an electric motor to provide braking power assistance actuated by a brake pedal and a transmission means interconnecting the brake pedal, the motor and a master cylinder piston, the transmission means being actuated by the brake pedal and having a frictional coupling to actuate the master cylinder piston, the friction of the frictional coupling increasing in proportion to the brake pedal pressure.

13 Claims, 3 Drawing Figures



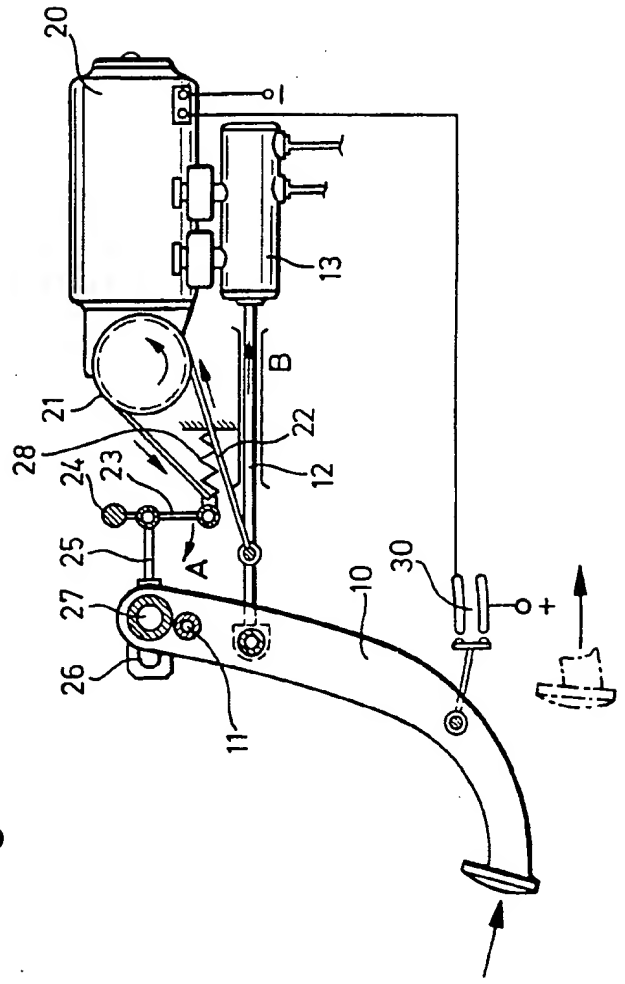


Fig. 1

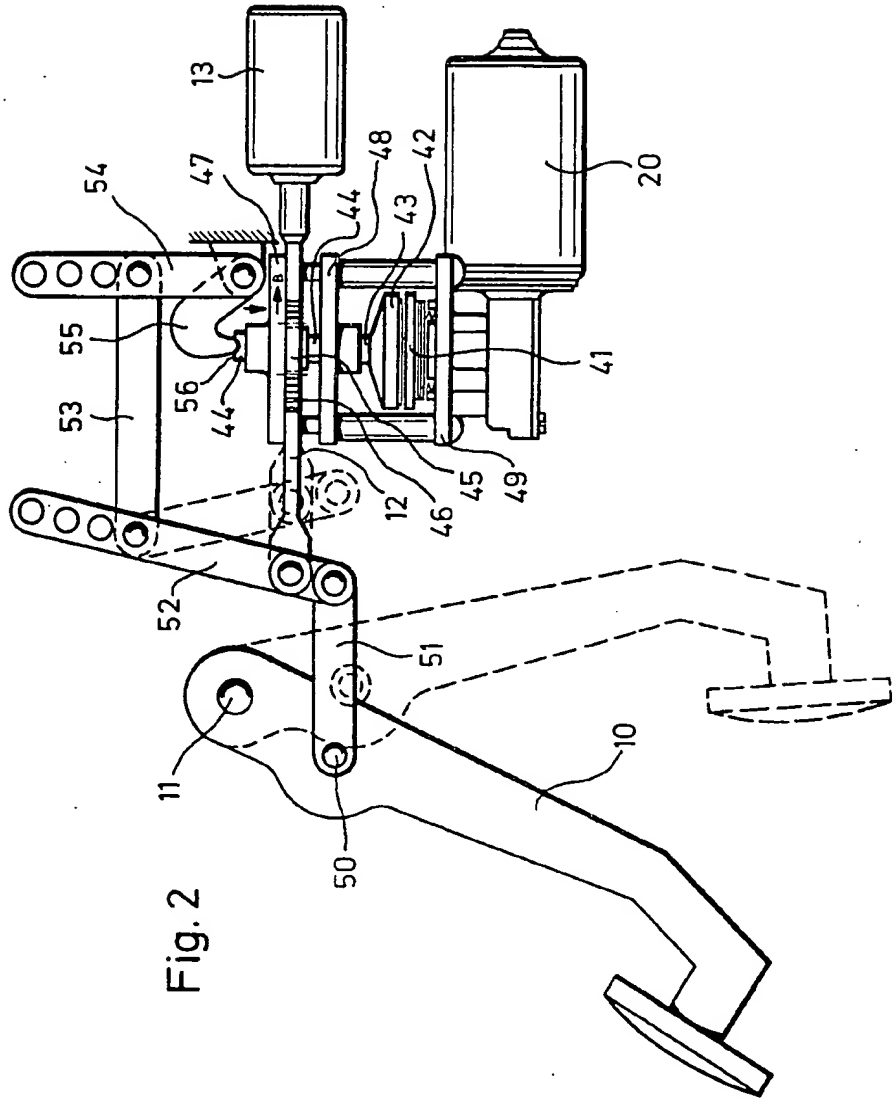
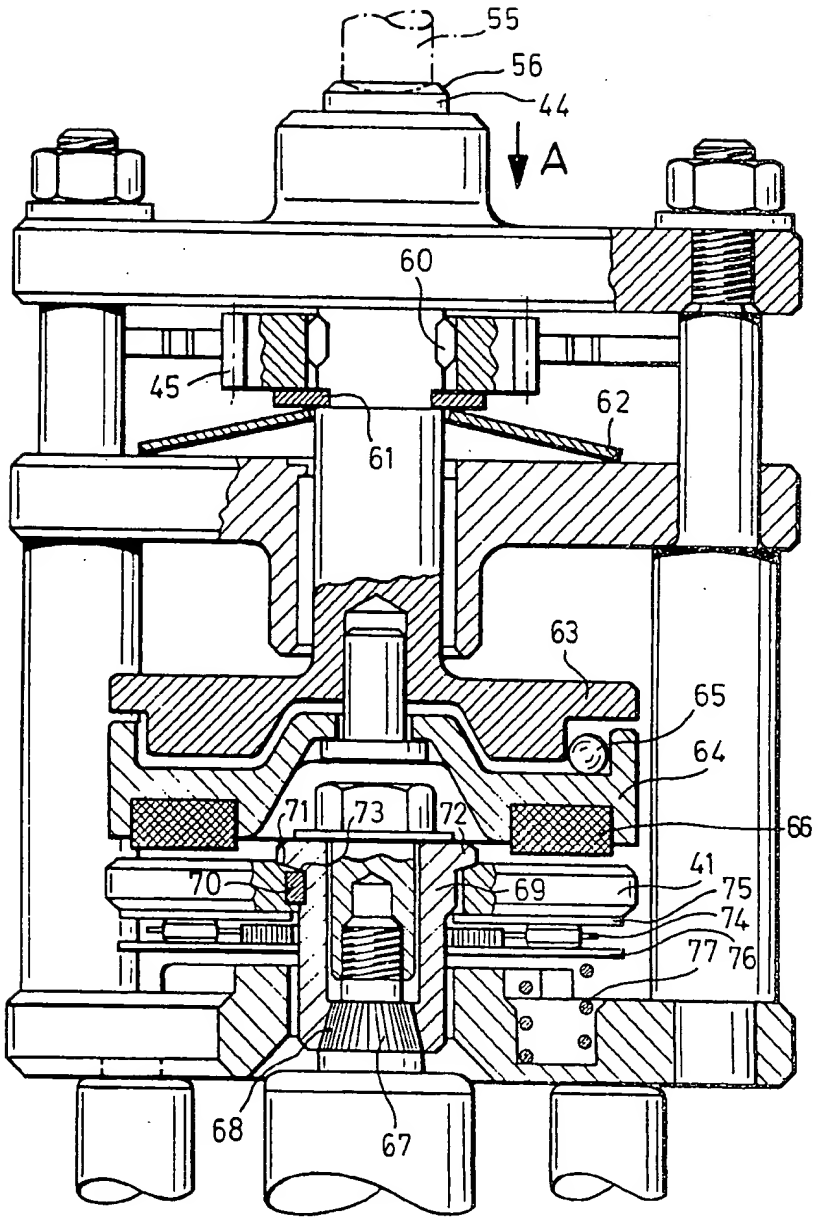


Fig. 2

Fig. 3



ELECTROMOTIVE POWER BRAKE

Background of the Invention

This invention relates to a device for braking of motor vehicles by a brake pedal, a brake actuated thereby and an electromotive drive for brake power assistance.

Modern motor vehicles are increasingly equipped with so-called power-assisted brake systems which build up a sufficiently high braking pressure when only a weak pressure is applied to the brake pedal. In many cases, the underpressure in the intake manifold of the vehicle engine is used for this brake power assistance which, however, is not so easily attainable for diesel-engined vehicles.

From the German Patent No. DT-OS 2,064,788 a braking system is already known in which a brake cable is stretched manually or by means of an electric motor, the brake cable directly acting on a friction disc fastened to the rear axle of the motor vehicle in a manner such that the friction disc is protected against twisting. This brake with electromotive brake power assistance is provided for big trucks in addition to the normal drum brakes. The brake power of these usual drum brakes is thereby not intensified.

Summary of the Invention

An object of the present invention is to provide a device for braking of motor vehicles in which the brake power of the available drum or disc brake is intensified.

Another object of the present invention is that the device is designed in such a way that it can be installed into any motor vehicle at a later time.

A feature of the present invention is the provision of an electromotive power brake comprising: an electric motor actuated by a brake pedal, the motor providing braking power assistance; a master cylinder having a tappet push rod connected to a master cylinder piston; and transmission means interconnecting the brake pedal, the motor and the tappet push rod, the transmission means having a frictional coupling to actuate the tappet push rod, the friction of the coupling increasing in proportion to the brake pedal pressure.

It is thereby essential that the electric motor mechanically acts on the brake pedal or also on a tappet push rod of a brake master cylinder of a motor vehicle coupled with the brake pedal, whereby the power of this device is derived from the pressure applied to the brake pedal by the driver.

The mechanical transmission of motion from the electric motor to the brake pedal must be designed in such a way that also in case of a defect of the auxiliary drive a further functioning of the brake in ensured.

Brief Description of the Drawing

Above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawing, in which:

FIG. 1 is a schematic view of a first embodiment of the device in accordance with the principles of the present invention comprising a friction disc and a skid band;

FIG. 2 is a schematic view of a second embodiment of the device in accordance with the principles of the present invention comprising friction discs being axially adjustable towards each other; and

FIG. 3 is a detail of the embodiment according to FIG. 2 on an enlarged scale.

Description of the Preferred Embodiment

In FIG. 1 a brake pedal is designated by 10. Brake pedal 10 is mounted so that it swivels at 11. To the brake pedal 10 a tappet push rod 12 is attached for actuating a piston in a brake master cylinder 13. The actual brake system is not shown in detail, because it corresponds to the usual ones.

An electric motor 20 serves for the brake power assistance. Electric motor 20 drives a friction disc 21 through a suitable speed reduction gear in the direction of rotation shown. A skid band 22 cooperates with friction disc 21. One end of skid band 22 is fixed to tappet push rod 12 and its other end to a tensioning lever 23. Tensioning lever 23 is swivelled round the point of rotation 24 by a push rod 25. Push rod 25 has a broader portion with a slot 26 which engages a cam 27 fixed to brake pedal 10. Tensioning lever 23 is acted upon by a spring element 28 which has a tendency to swivel tensioning lever 23 in such a way that the force-locking connection between friction disc 21 and skid band 22 is released.

Electric motor 20 is connected to a voltage source (not shown) via a switch 30 as soon as brake pedal 10 is actuated. Upon actuation of brake pedal 10 a low brake pressure is built up at first in brake master cylinder 13 via tappet push rod 12. Simultaneously, electric motor 20 is energized. Cam 27 is displaced in slot 26 of push rod 25, which at first has not any influence. Thus, the brake pressure is not assisted at the beginning of the braking process.

When, however, brake pedal 10 is pressed such that push rod 25 and thereby tensioning lever 23 is displaced in direction of arrow A against the force of spring element 28, skid band 22 is stretched. The torque of electric motor 20 is now transmitted to skid band 22 by friction disc 21. Tappet push rod 12 is displaced in the direction of arrow B and, thus, the brake pressure in brake master cylinder 13 is intensified. Thus, skid band 22 and friction disc 21 form a forcelocking coupling, whereby the frictional connection depends on the pressure applied to brake pedal 10. The coupling via skid band 22 and friction disc 21 is acting only in one direction, that is from electric motor 20 to tappet push rod 12 and, hence, to brake pedal 10.

This arrangement ensures that tappet push rod 12 can also be actuated without any handicap when electric motor 20 is defective and friction disc 21 is blocked. In this embodiment it is furthermore essential that electric motor 20 starts before its torque intensifies the brake system. The reason is that because of slot 26 the lever transmission of levers 25 and 23 has a certain clearance. Besides spring element 28 is important which, when the brake pedal is reset, adjusts tensioning lever 23 in a way that the frictional connection between friction disc 21 and skid band 22 is released and, thus, does not act against the setting back of tappet push rod 12 via the still running electric motor 20.

In the embodiment of FIG. 2, electric motor 20 drives a friction disc 41 which cooperates with a second friction disc 42. A shaft 44 with a pinion 45 is coupled with friction disc 42 via an overrunning-clutch drive 43. The pinion 45 cooperates with a toothed rack 46 which simultaneously serves as a tappet push rod for actuating

a piston in brake master cylinder 13. The two friction discs 41 and 42 working as a coupling are axially adjustable towards each other. All these parts are held in a bearing cage having two drive end shields 47 and 48 and a mounting plate 49 all bolted to each other.

A four-bar mechanism including the levers 51, 52, 53 and 54 is attached to a pivot 50 on brake pedal 10. A driven rocking arm 55 is connected with lever 54 in a manner that prevents its twisting. Driven rocking arm 55 is designed in such a way that it presses on the front side of shaft 44. Thus the circular movement of pivot 50 via the four-bar mechanism is transformed into an axial movement of shaft 44 and thereby via the overrunning-clutch drive 43 into an axial movement of friction disc 42.

With reference to FIG. 3 some details of the design are described below.

The shaft 44 via the drive key 60 is fastened to pinion 45 in a manner that prevents its twisting. A cup spring 62 supports on a Seeger circlip ring 61, cup spring 62 having the tendency to press shaft 44 upwards. A driven pulley 63 of a usual overrunning-clutch drive 43 is formed in one piece on shaft 44. The drive disc of the overrunning-clutch drive is designated by 64, the freewheel balls by 65. Drive disc 64 simultaneously serves as friction disc 42. Drive disc 64 has a friction lining 66. The driven shaft 67 of electric motor 20 has a taper serration at 68. A bushing 69 with an internal toothing is axially put on driven shaft 67 and fastened by means of a screw connection. Bushing 69 is coupled with the other friction disc 41 via drive keys 70 in a manner that prevents its twisting. Friction disc 41 is movably supported on bushing 69 via a kind of cup bearing. For this purpose one front side of friction disc 41 is provided with a ball socket 71 and bushing 69 has radially projecting flanges 72 with an adapted ball radius which is indicated at 73. Friction disc 41 is supported on mounting plate 49 via a needle bearing with rolls 74 between two steel discs 75 and 76 and several pressure springs 77.

The device according to FIGS. 2 and 3 operates as follows: Upon actuation of brake pedal 10 at first the electric motor 20 is started. However, there does not yet exist a frictional connection between friction discs 41 and 42, because friction disc 42 is pressed upwards by the cup spring 62 opposite to the direction of arrow A. When the brake pedal is pressed stronger driven rocking arm 55 is swivelled via the lever transmission of levers 51, 52, 53 and 54 and thereby presses shaft 44 and, thus, friction disc 42 against the tension of cup spring 62 in the direction of arrow A. The frictional connection between friction discs 41 and 42 is connected and thereby pinion 45 via overrunning-clutch drive 43 is turned round in one direction of rotation, so that toothed rack 46 is adjusted in direction of arrow B. The brake pressure in the brake master cylinder is thereby increased. Again the frictional connection between friction discs 41 and 42 is increased as the adjusting angle of brake pedal 10 is increased. This arrangement is different than that of FIG. 1, since coupling 41 is acting in both directions of rotation. Nevertheless toothed rack 46 can also be adjusted, when the electric motor is blocked, because between frictional disc 42 and pinion 45 overrunning-clutch drive 43 is interposed in the pertinent direction of rotation.

It can be seen from the descriptions that such a power brake system can easily be installed into motor vehicles at a later time, because it represents a compact construction unit. Thus, only slight changes have to be made at the tappet push rod and at the brake pedal for attaching the lever transmission mechanism.

While we have described above the principles of our invention in connection with specific apparatus it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the objects thereof and in the accompanying claims.

We claim:

1. An electromotive power brake comprising:
an electric motor actuated by a brake pedal, said motor providing braking power assistance;
a master cylinder having a tappet push rod connected to a master cylinder piston; and
transmission means interconnecting said brake pedal, said motor and said tappet push rod, said transmission means having a frictional coupling to actuate said tappet push rod, the friction of said coupling increasing in proportion to the brake pedal pressure.

2. A power brake according to claim 1, wherein said coupling only acts in one direction from said motor to said brake pedal.

3. A power brake according to claim 2, wherein said coupling includes
a friction disc directly driven by said motor, and
a skid band embracing said friction disc and having one end coupled to said brake pedal and the other end coupled to said tappet push rod.

4. A power brake according to claim 3, wherein said transmission means further includes
a push rod element attached to said brake pedal; and
a tensioning lever connected to and swivelled by said push rod element about a point of rotation;
said one end of said skid band being coupled to said tensioning lever, said tensioning lever stretching said skid band towards said friction disc.

5. A power brake according to claim 4, wherein said transmission means further includes
a spring element connected to said tensioning lever to reset said tensioning lever.

6. A power brake according to claim 5, wherein said transmission means further includes
a cam disposed in said brake pedal and a slot in said push rod element.

7. A power brake according to claim 1, wherein said transmission means further includes
lever transmission means interconnecting said brake pedal and said coupling.

8. A power brake according to claim 1, wherein said coupling acts in both directions of rotation, and said transmission means further includes
an overrunning-clutch drive disposed between said coupling and both of said brake pedal and said tappet push rod.

9. A power brake according to claim 8, wherein said coupling includes
a first friction disc driven by said motor, and
a second friction disc connected to said overrunning-clutch drive,
said overrunning-clutch drive driving a pinion fixed to a shaft, said pinion mating with a toothed rack attached to said brake pedal and said tappet push rod,
said first and second friction discs being axially movable towards each other.

10. A power brake according to claim 9, wherein said transmission means further includes

a pivot disposed in said brake pedal; and

a five-lever transmission mechanism interconnecting said pivot and said shaft to translate circular motion at said pivot to straight-line motion at said shaft.

11. A power brake according to claim 10, wherein said five-lever transmission mechanism includes

a driven rocking arm acting on the adjacent end of said shaft.

12. A power brake according to claim 11, wherein said toothed rack is attached to one lever of said transmission mechanism and said tappet push rod.

13. A power brake according to claim 12, wherein said first friction disc is secured to a driving shaft of said motor by a cup bearing.

* * * * *

US005797467A

United States Patent [19]

Watanabe

[11] Patent Number: 5,797,467

[45] Date of Patent: Aug. 25, 1998

[54] **DEVICE FOR PREVENTING AN ACCELERATOR OF A VEHICLE FROM BEING ERRONEOUSLY OPERATED**

[76] Inventor: **Masaei Watanabe**, 61-13 Mitsufuji 1-chome, Musashimurayama-shi, Tokyo, Japan

[21] Appl. No.: **581,515**

[22] PCT Filed: **May 17, 1995**

[86] PCT No.: **PCT/JP95/00939**

§ 371 Date: **Jan. 11, 1996**

§ 102(e) Date: **Jan. 11, 1996**

[87] PCT Pub. No.: **WO95/31349**

PCT Pub. Date: **Nov. 23, 1995**

[30] **Foreign Application Priority Data**

May 17, 1994 [JP] Japan 6-137772

[51] **Int. Cl.**[6] **B60D 1/12**

[52] **U.S. Cl.** ..... **180/271**; 74/501.5 R; 74/512; 74/560; 180/315; 403/DIG. 1

[58] **Field of Search** ..... 180/271, 282, 180/284, 315; 403/DIG. 1, 49; 74/560, 512, 501.5 R, 513

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Primary Examiner—Eric D. Culbreth

Attorney, Agent, or Firm—Pearne, Gordon, McCoy & Granger LLP

[57] **ABSTRACT**

A device for preventing an accelerator from being erroneously operated when an accelerator pedal of a motor vehicle is erroneously pushed down includes a magnetic coupling device comprising an accelerator interlocking member interlocking with an accelerator pedal and a throttle interlocking member connected to a throttle cable. When the accelerator pedal is pushed down during normal operation the throttle cable is operated through the magnetic coupling device to cause the motor vehicle to be accelerated. When the accelerator pedal (14) is erroneously pushed down in spite of the brake pedal being intended to be pushed down, the magnetic coupling device decouples and prevents the throttle valve from being operated and the motor vehicle from being accelerated.

33 Claims, 23 Drawing Sheets

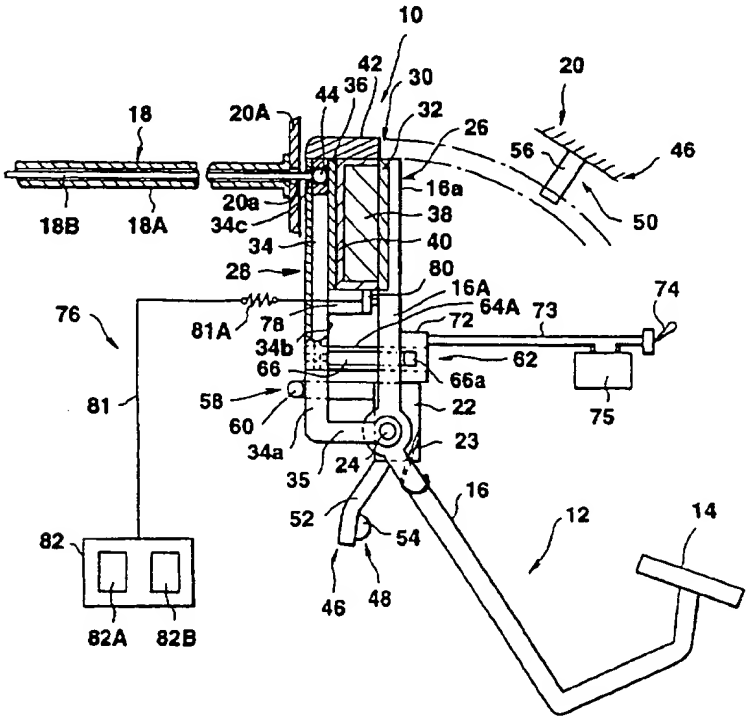

FIG. 1

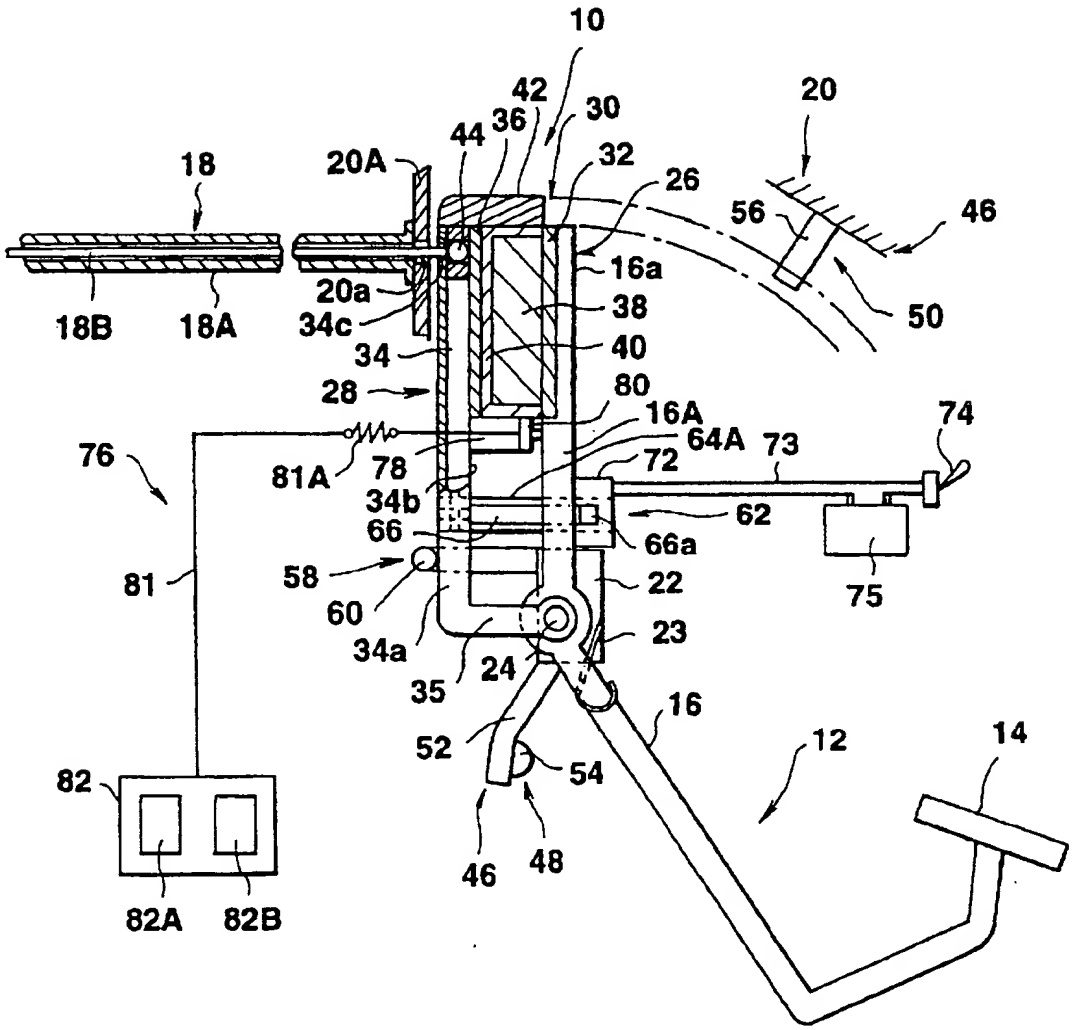
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FIG. 2

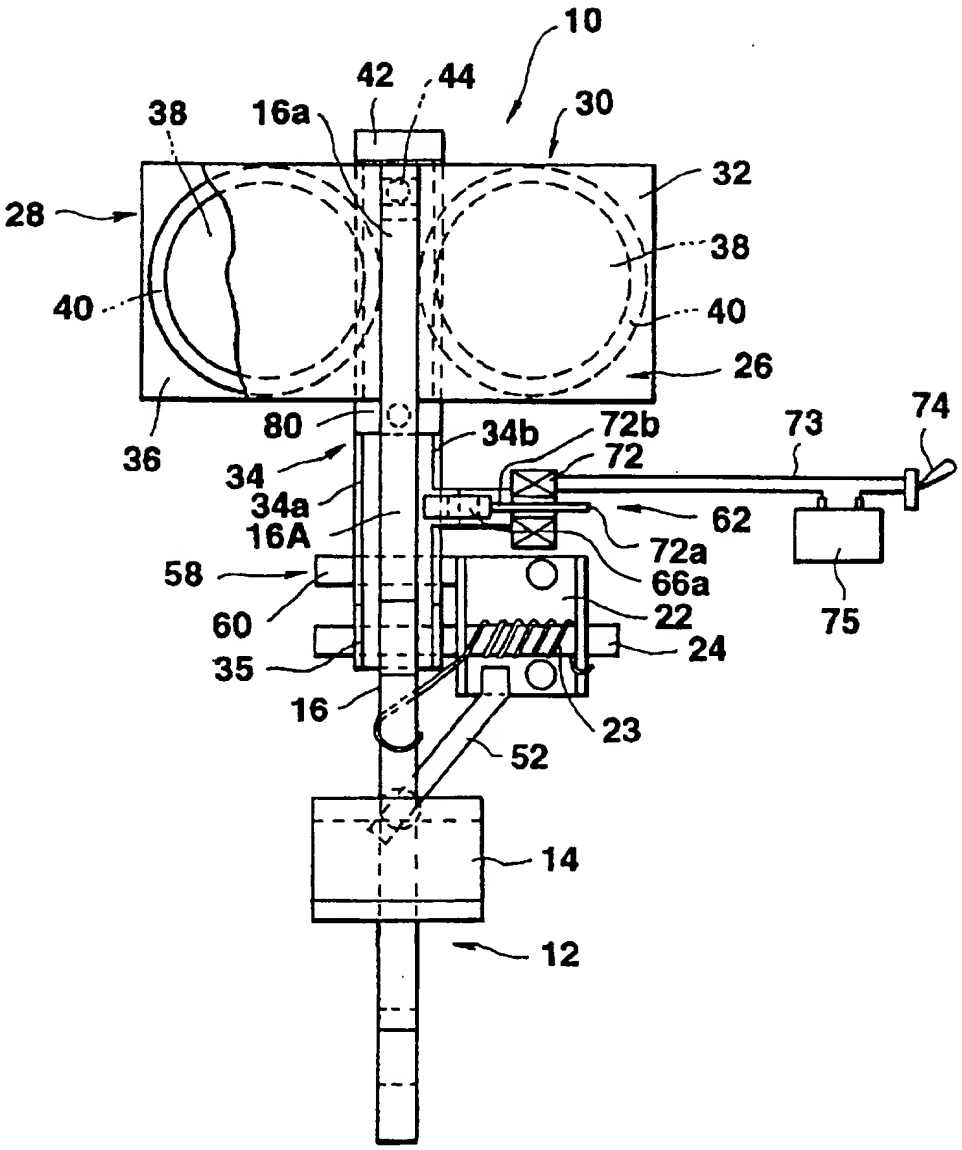
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FIG. 3

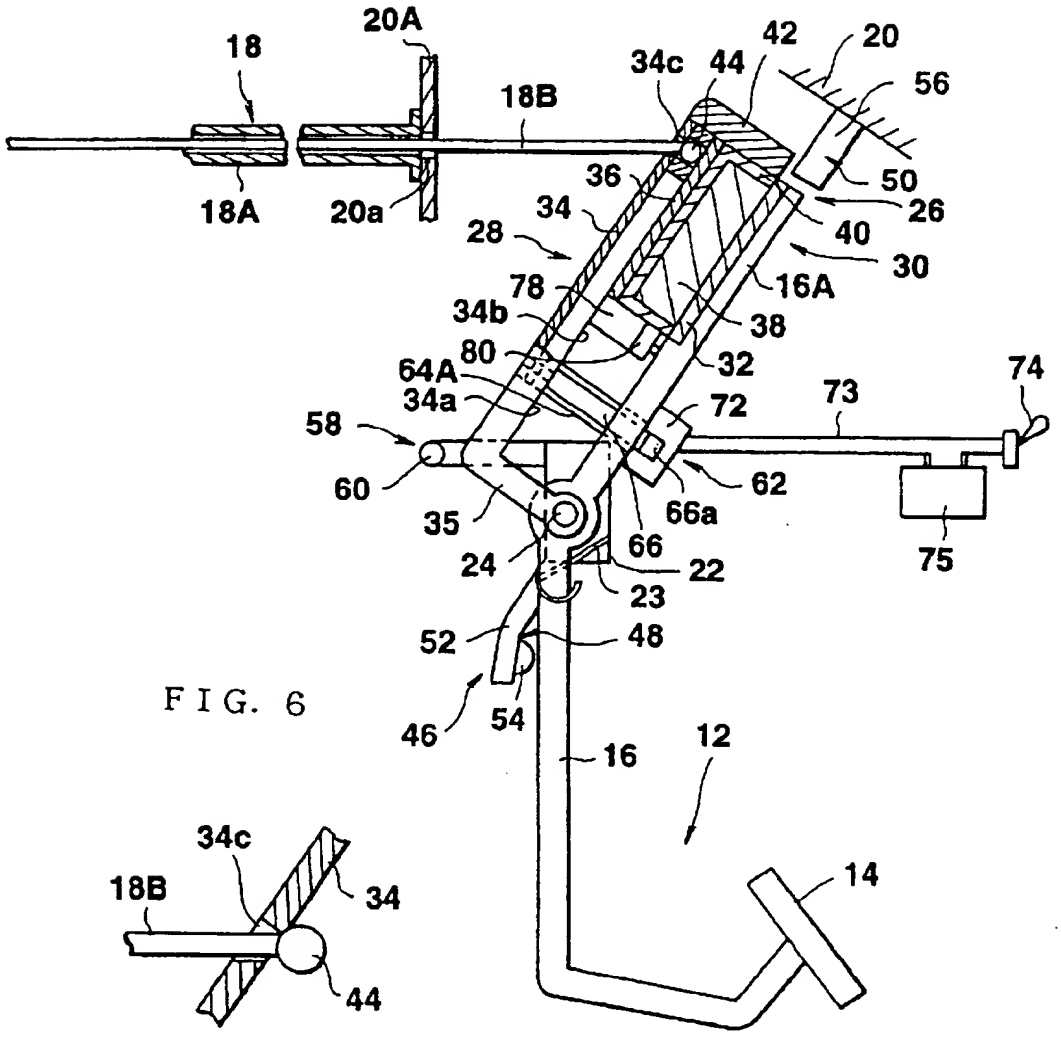
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FIG. 6

FIG. 4

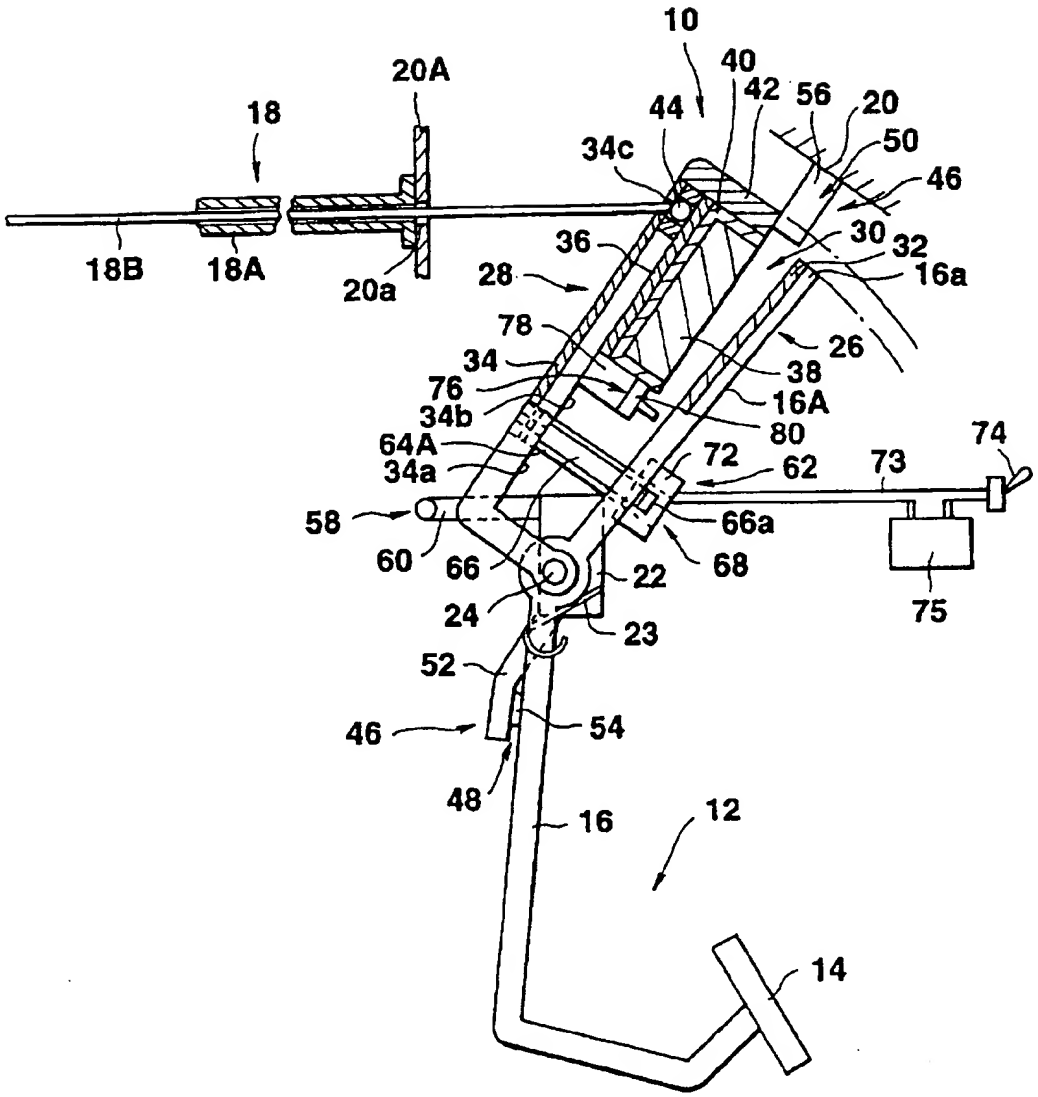
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FIG. 5

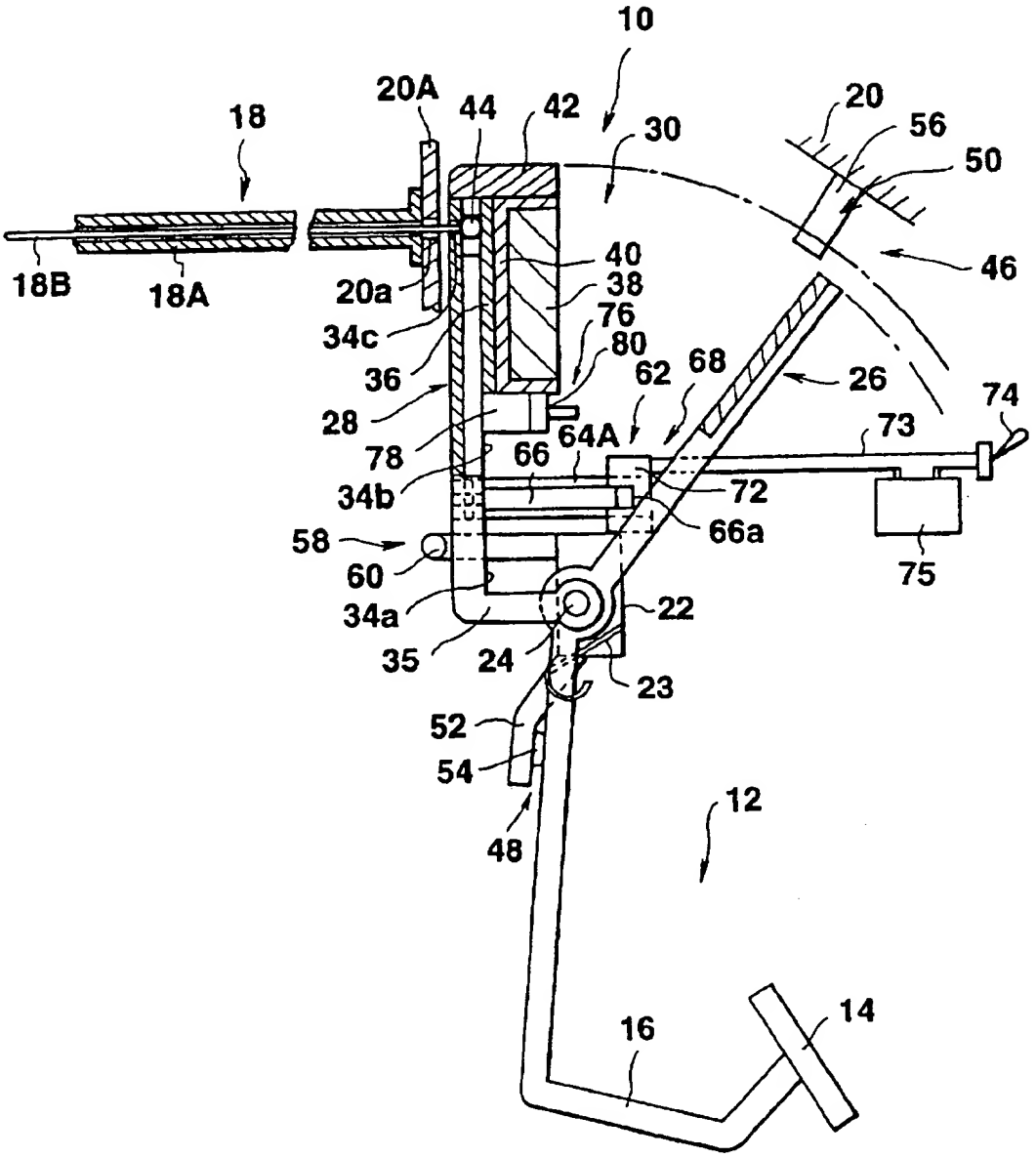
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FIG. 7

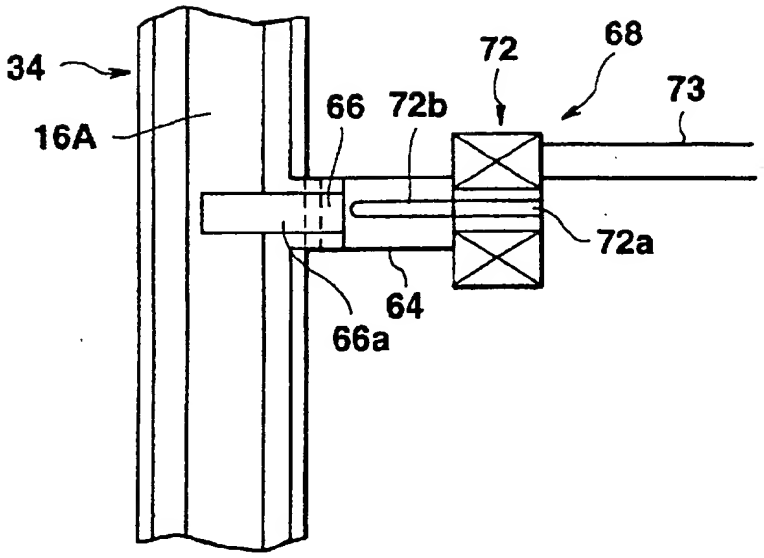

FIG. 8A

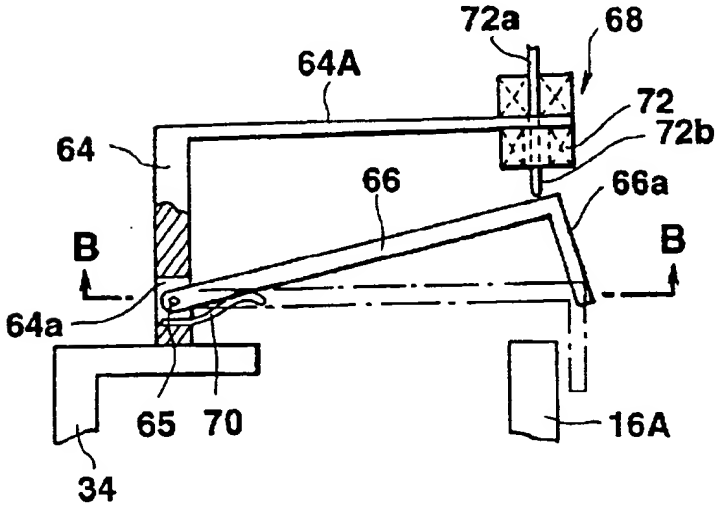

FIG. 8B

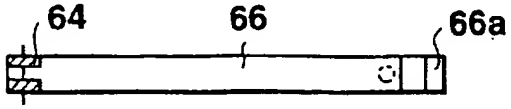

FIG. 9

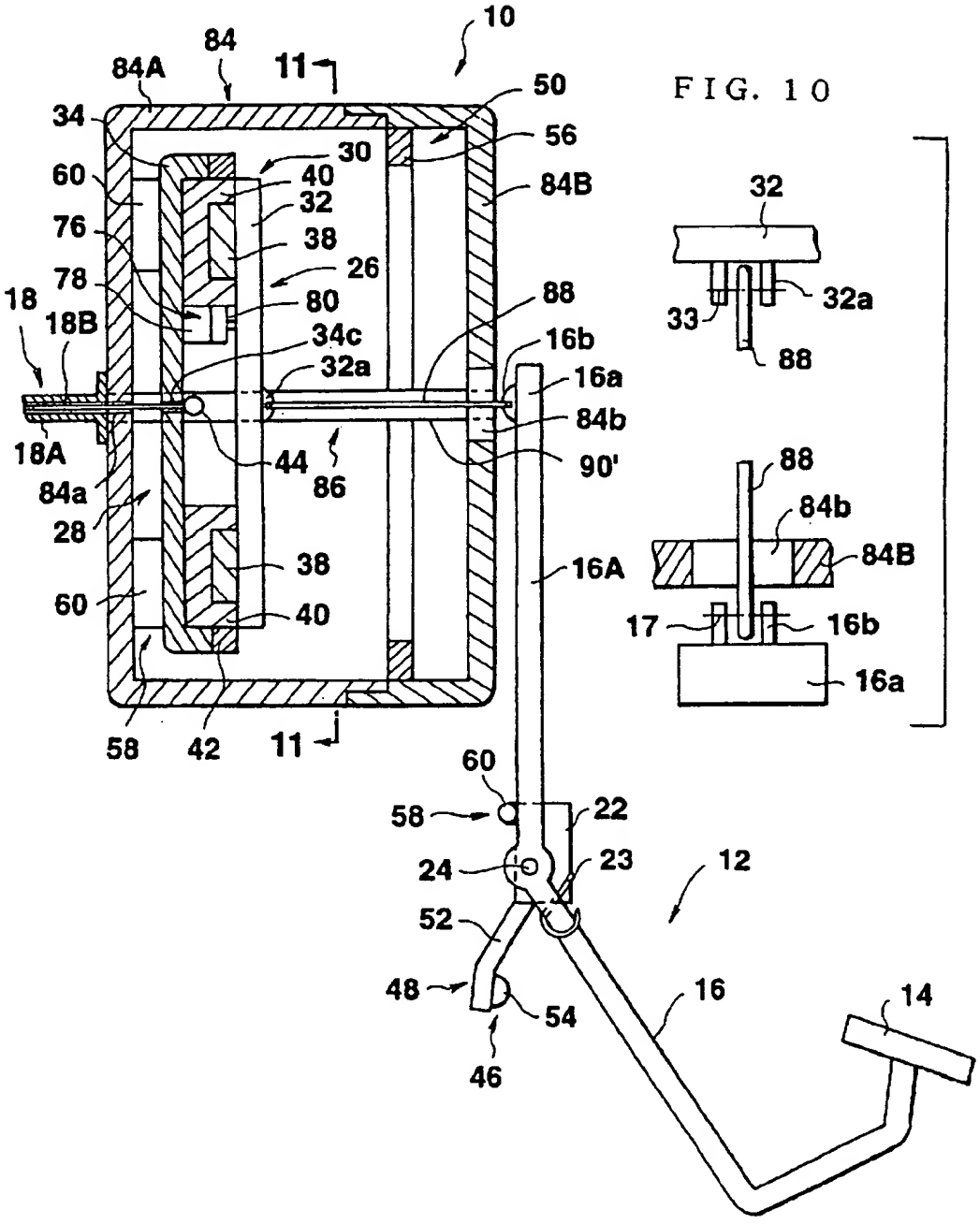
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FIG. 10

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FIG. 11

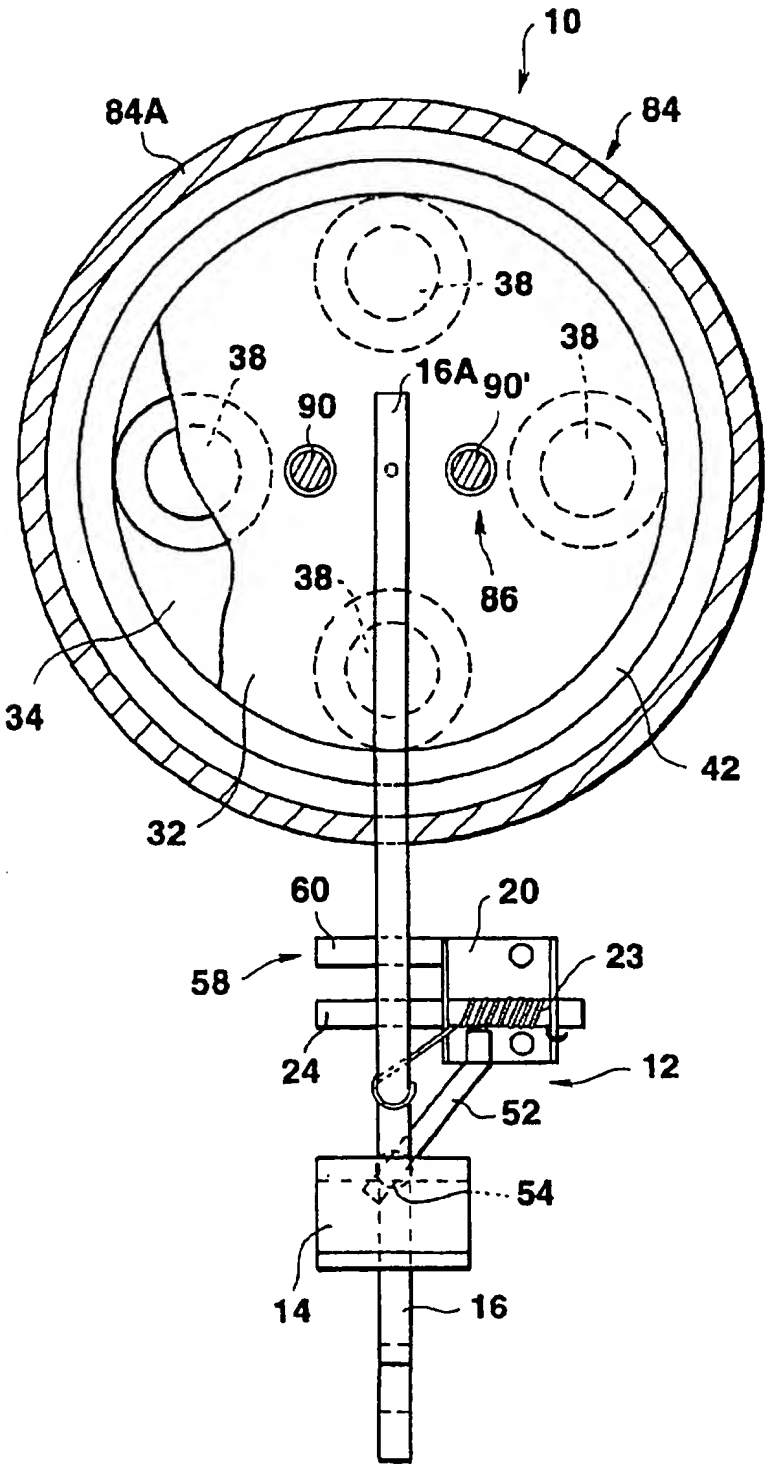
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FIG. 12

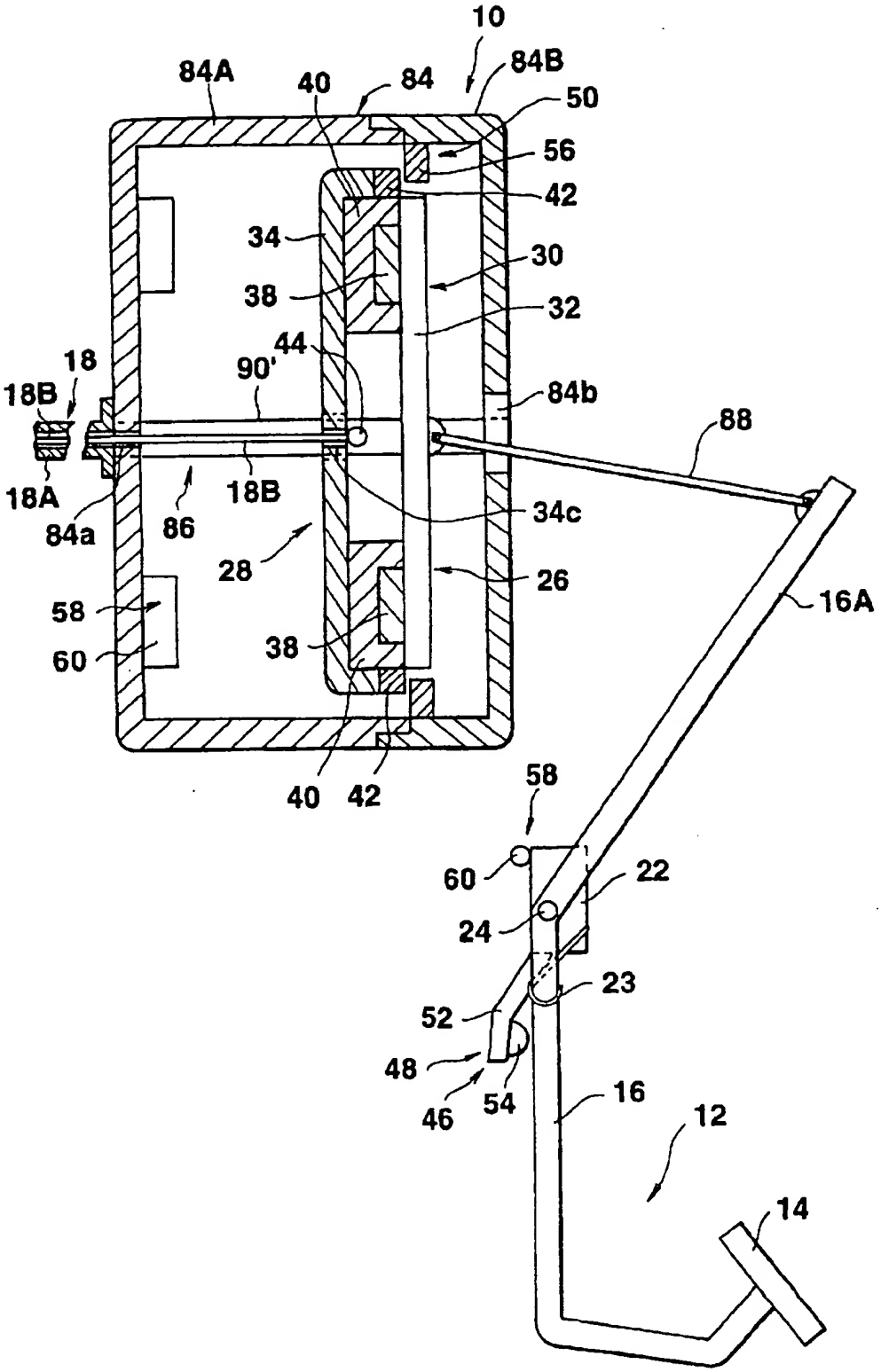
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FIG. 13

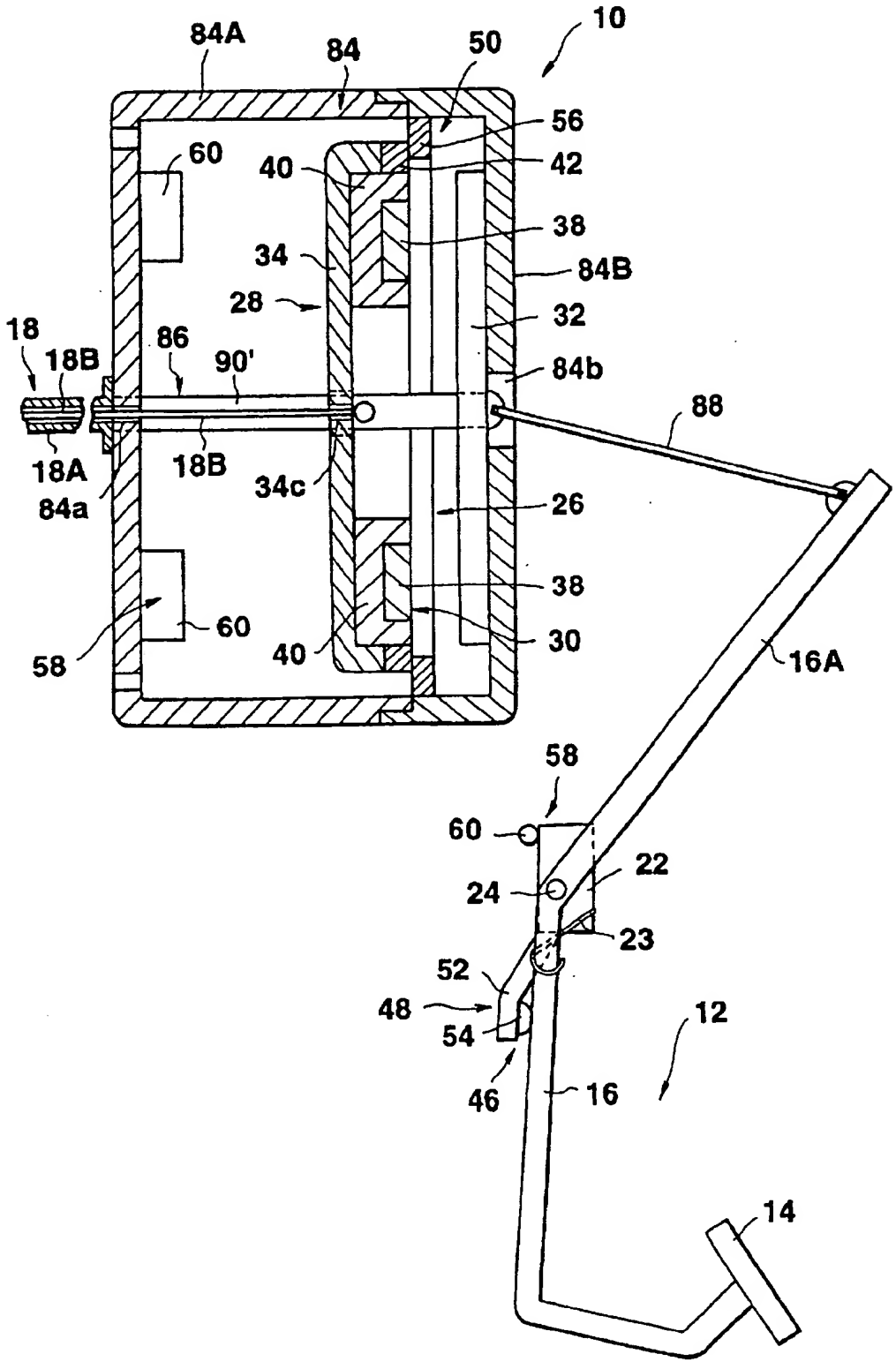
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FIG. 14

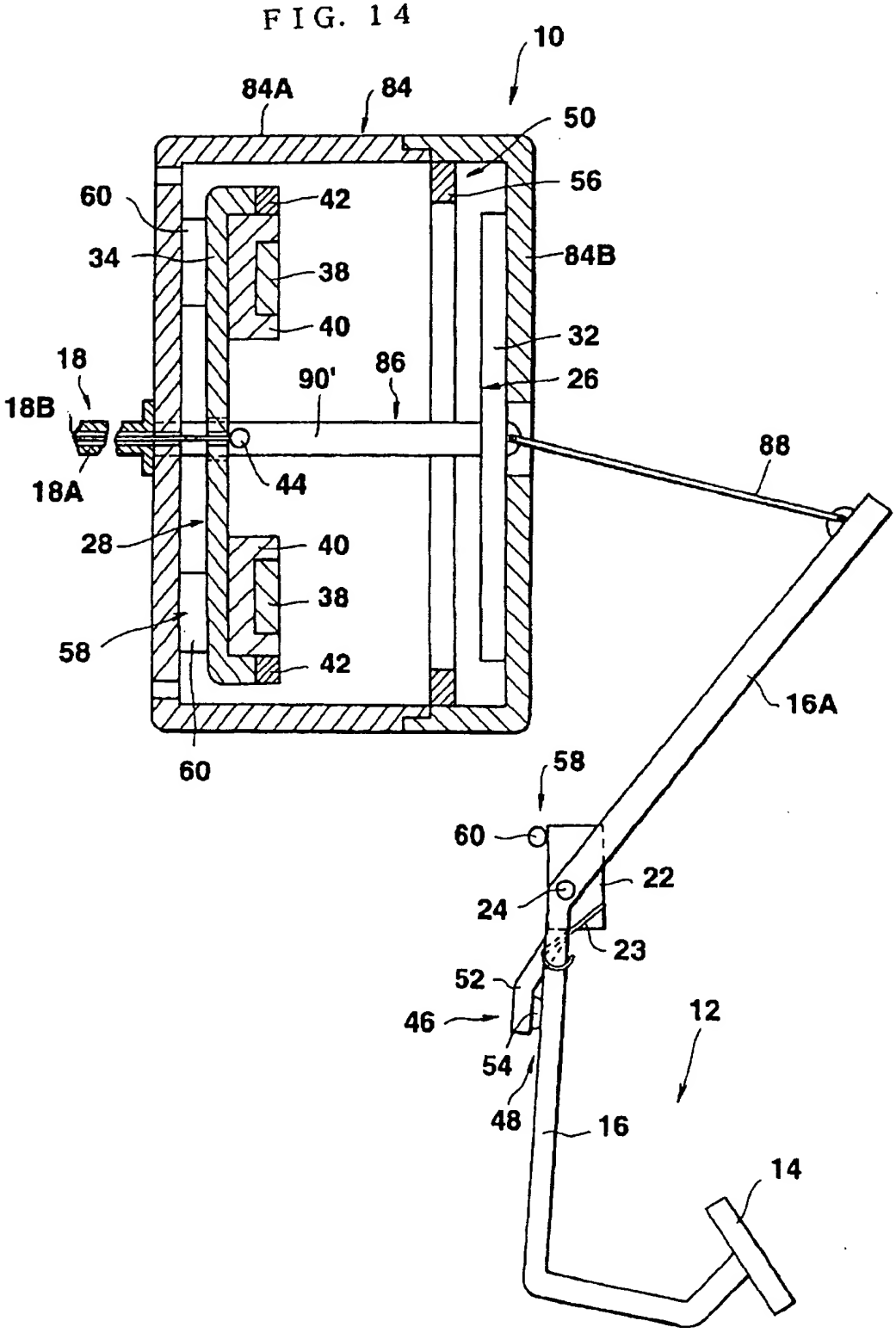
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FIG. 15

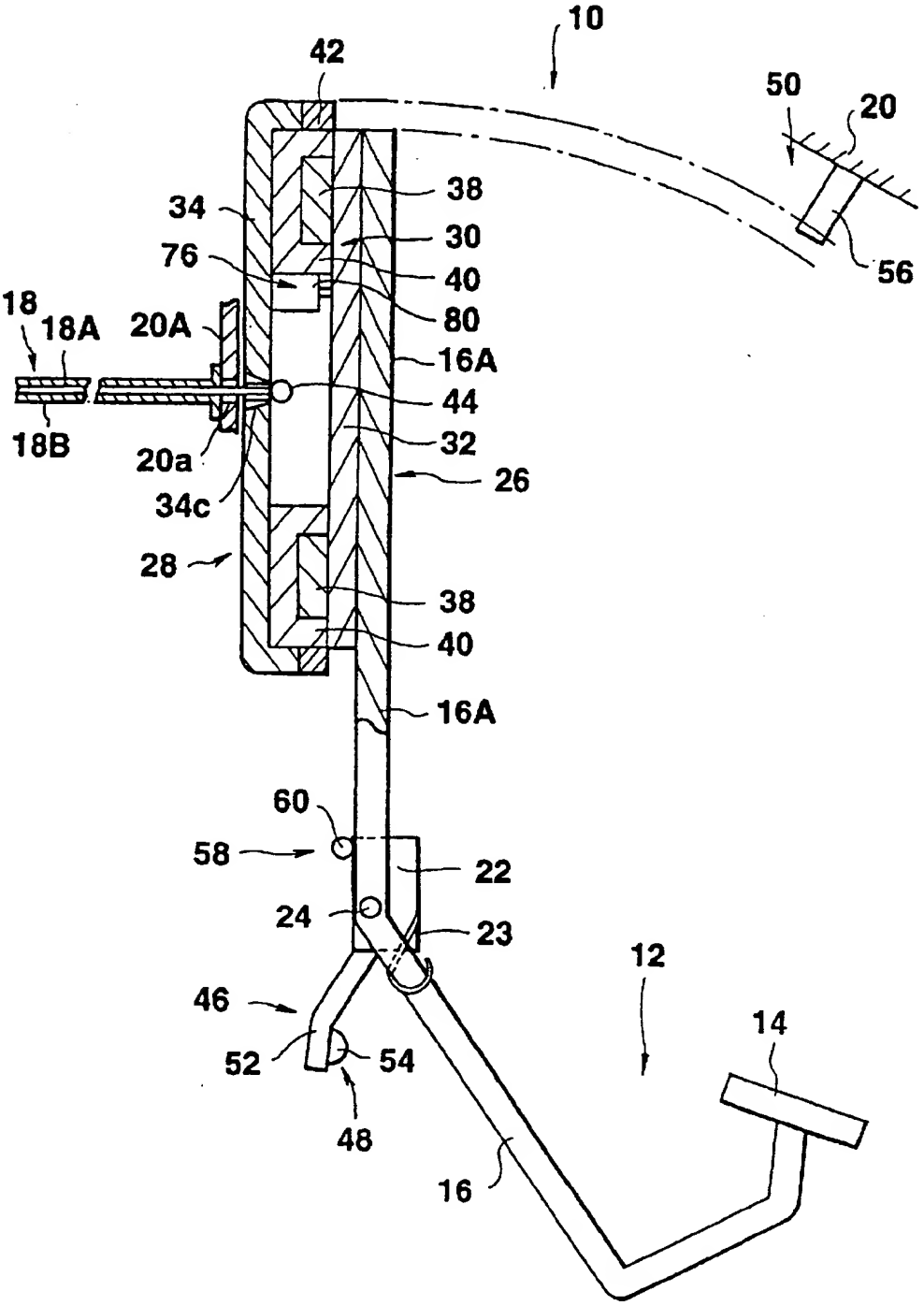
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FIG. 16

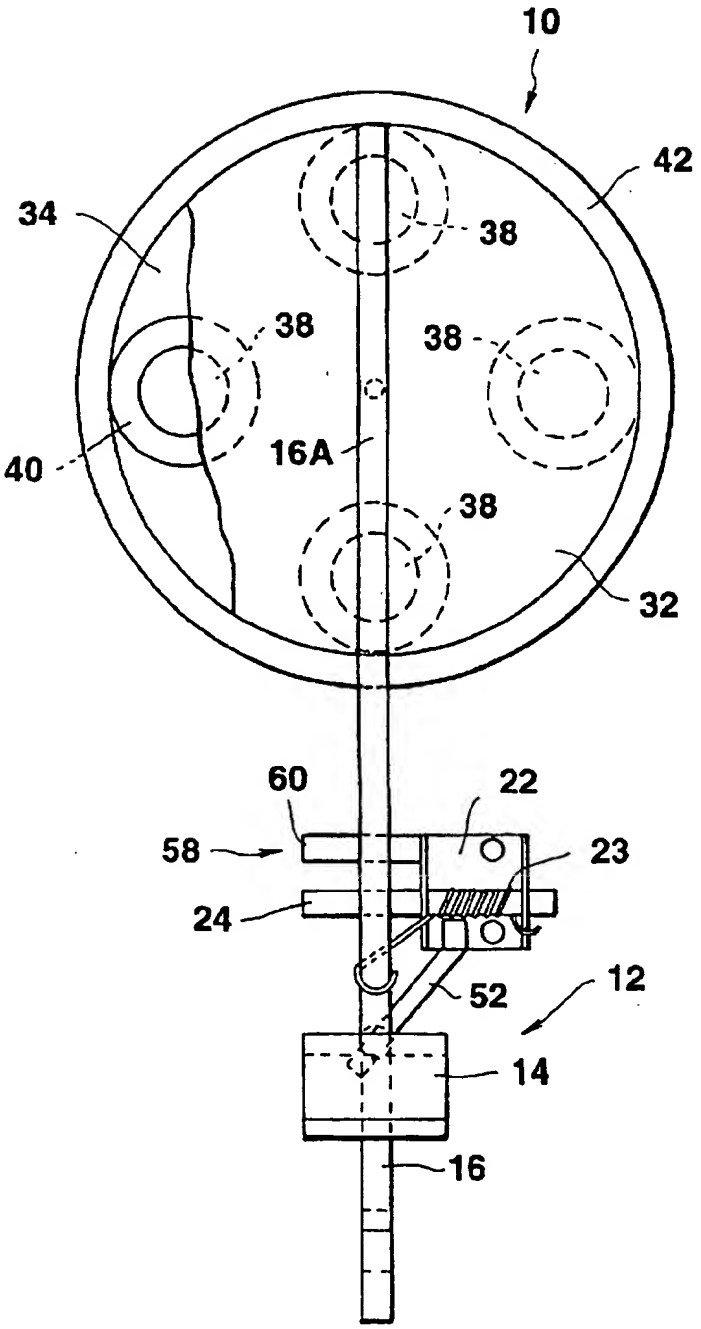

FIG. 17

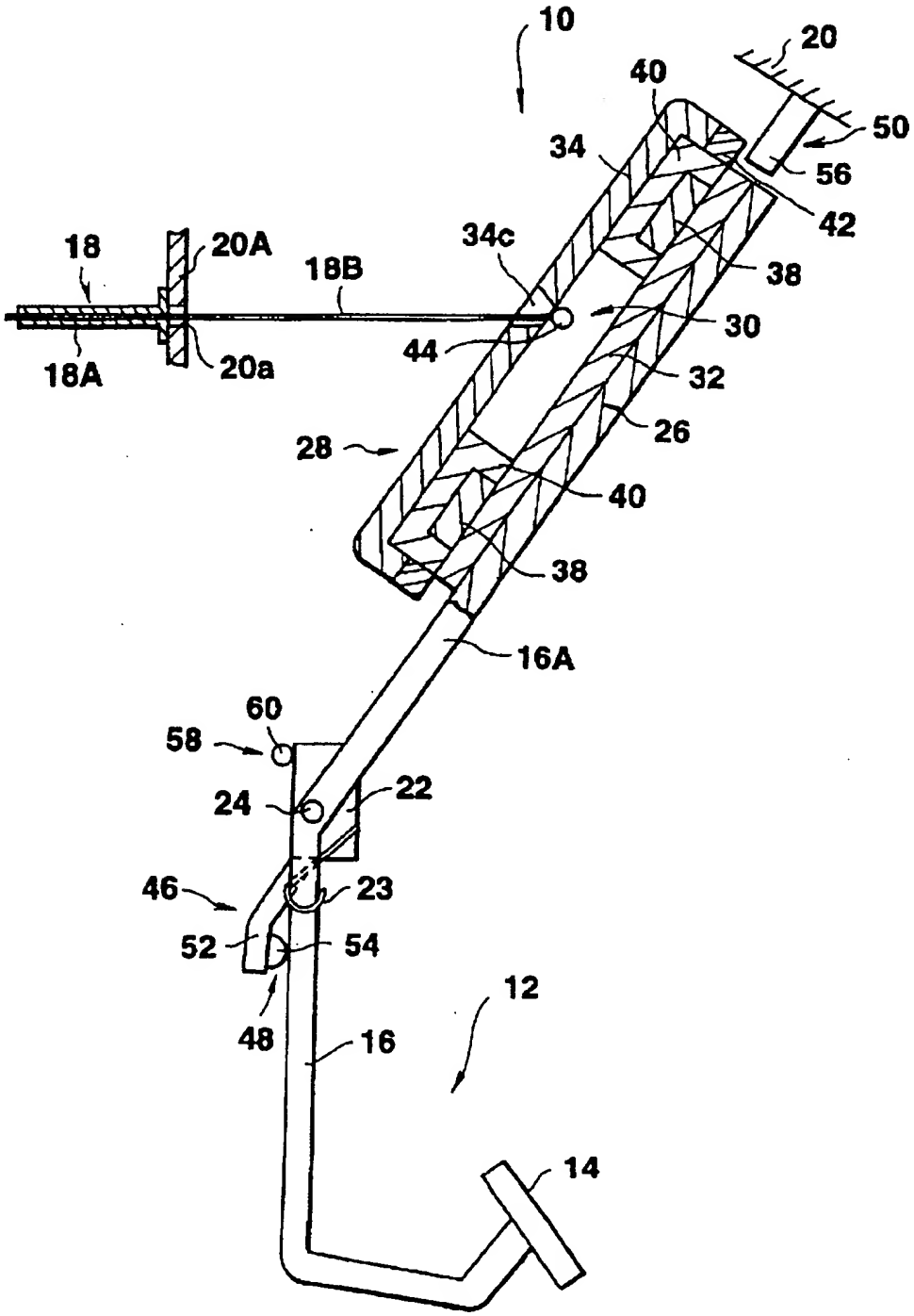
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FIG. 18

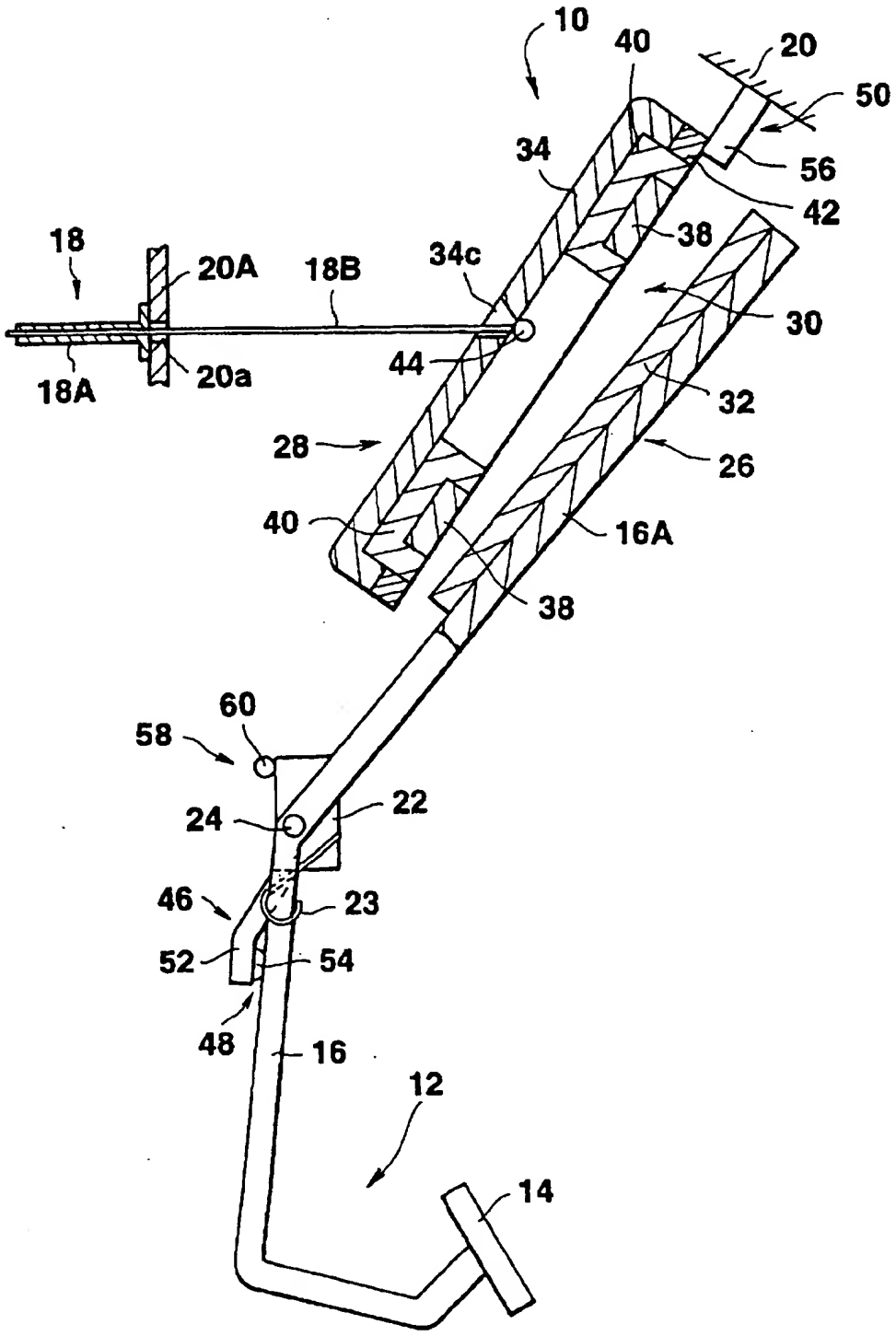
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FIG. 19

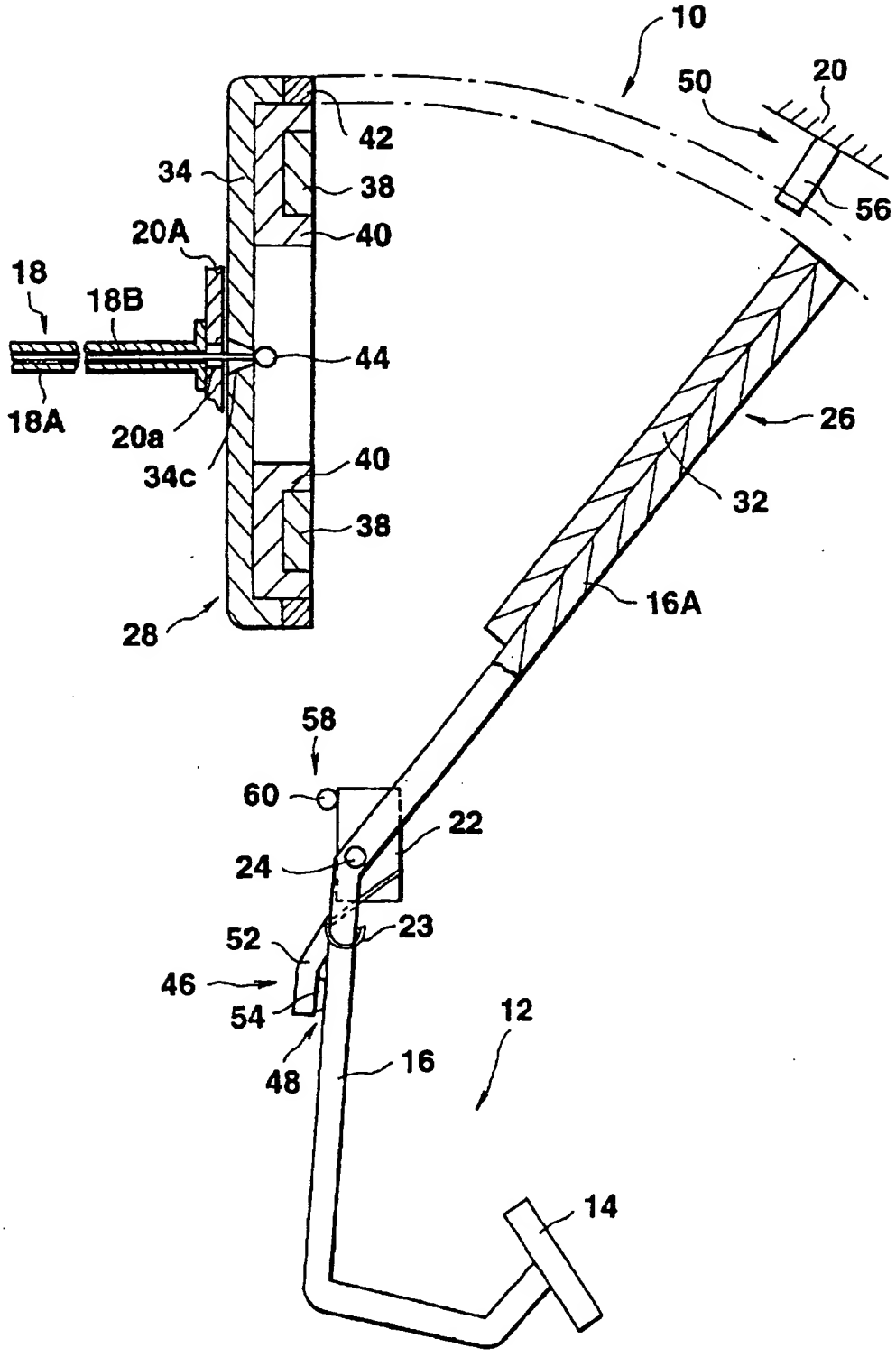
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FIG. 20

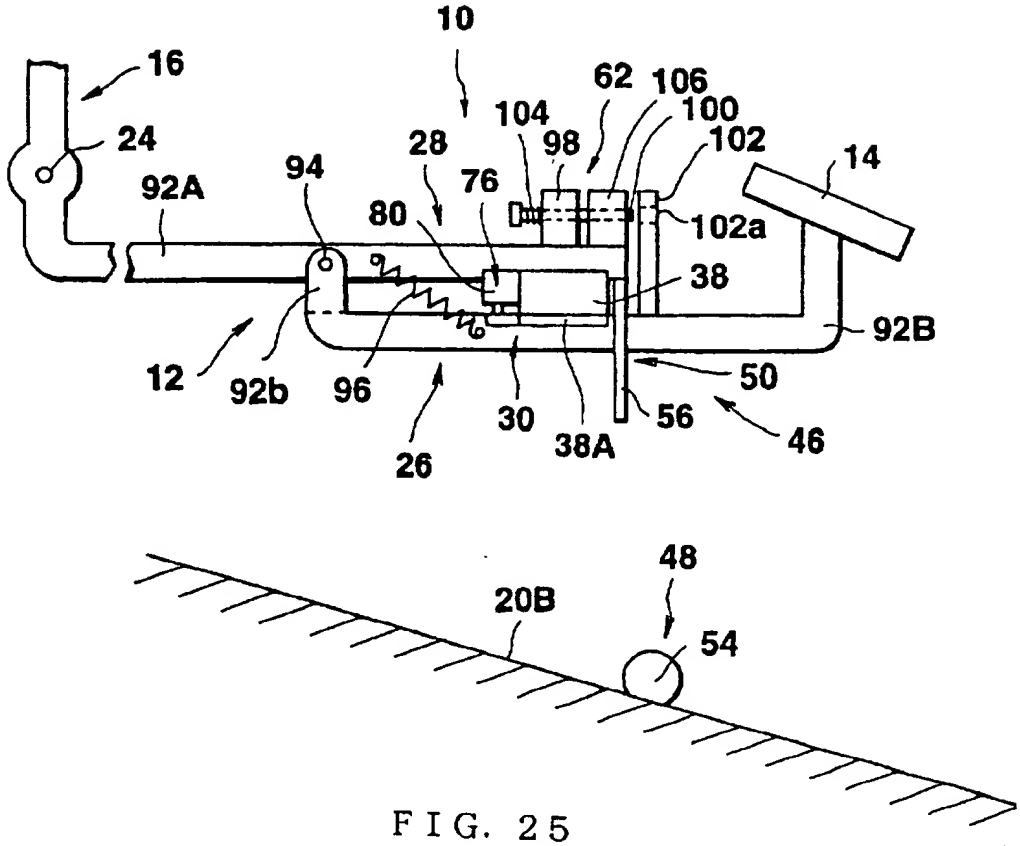
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FIG. 25

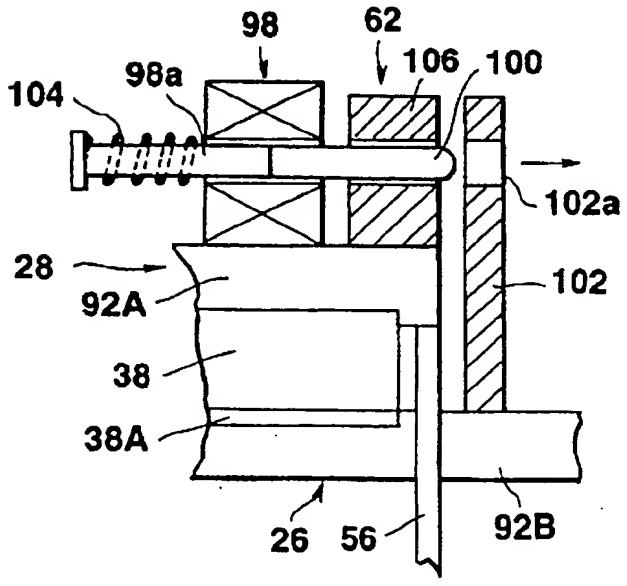
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FIG. 21

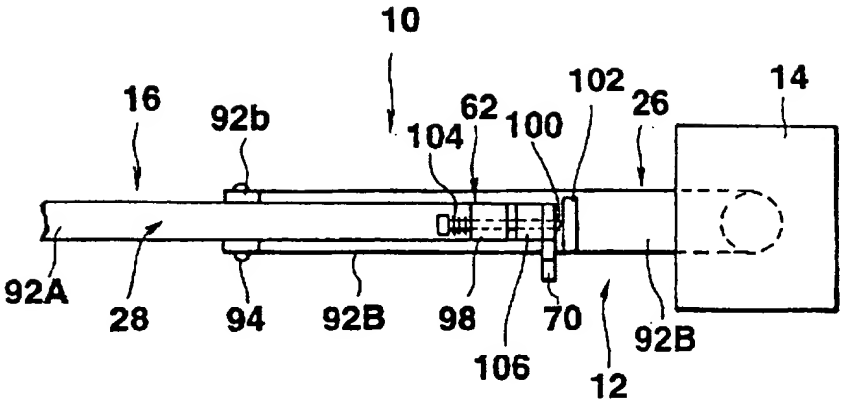
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FIG. 22

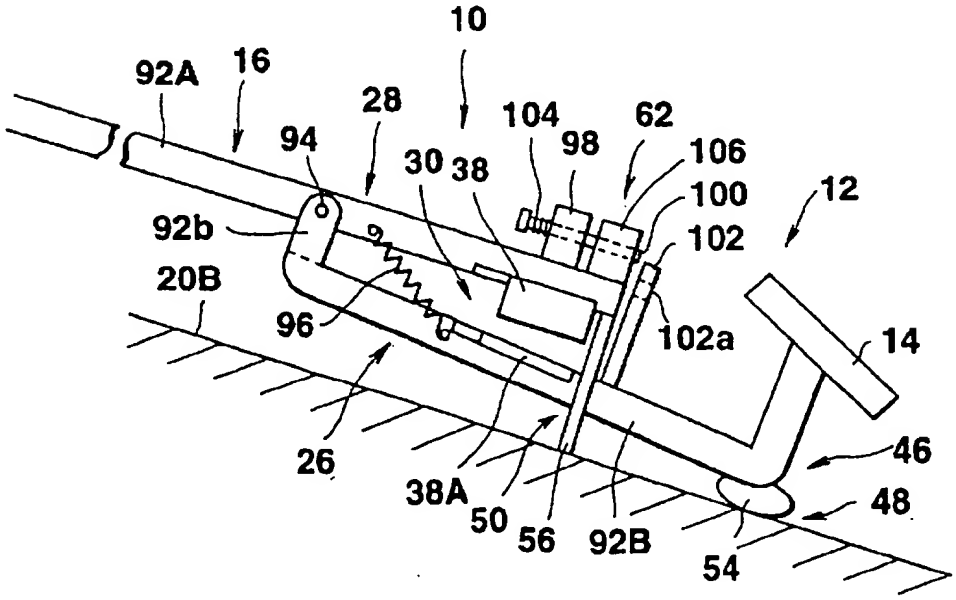
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FIG. 23

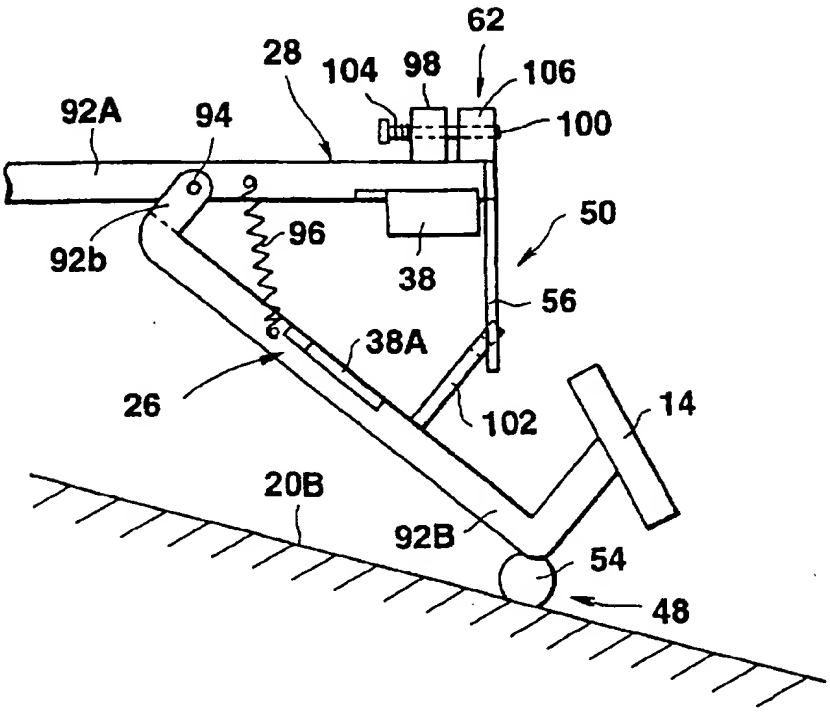

FIG. 24

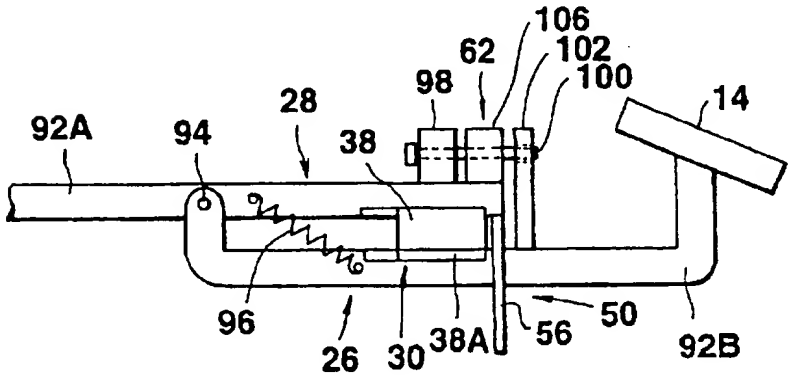

FIG. 31

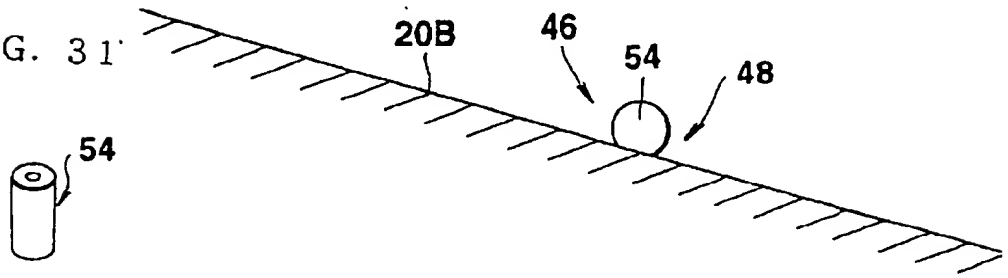

FIG. 26

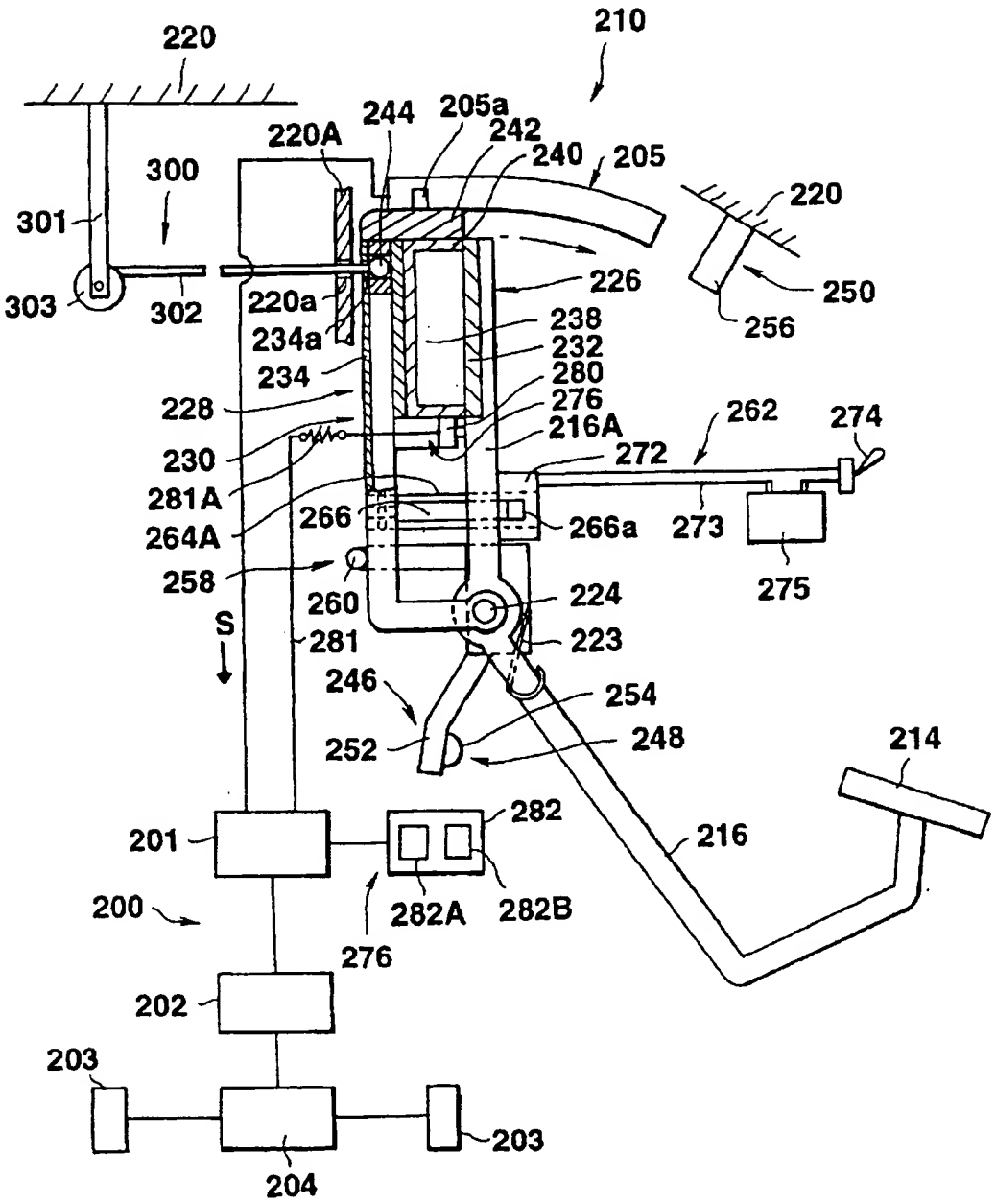
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FIG. 27

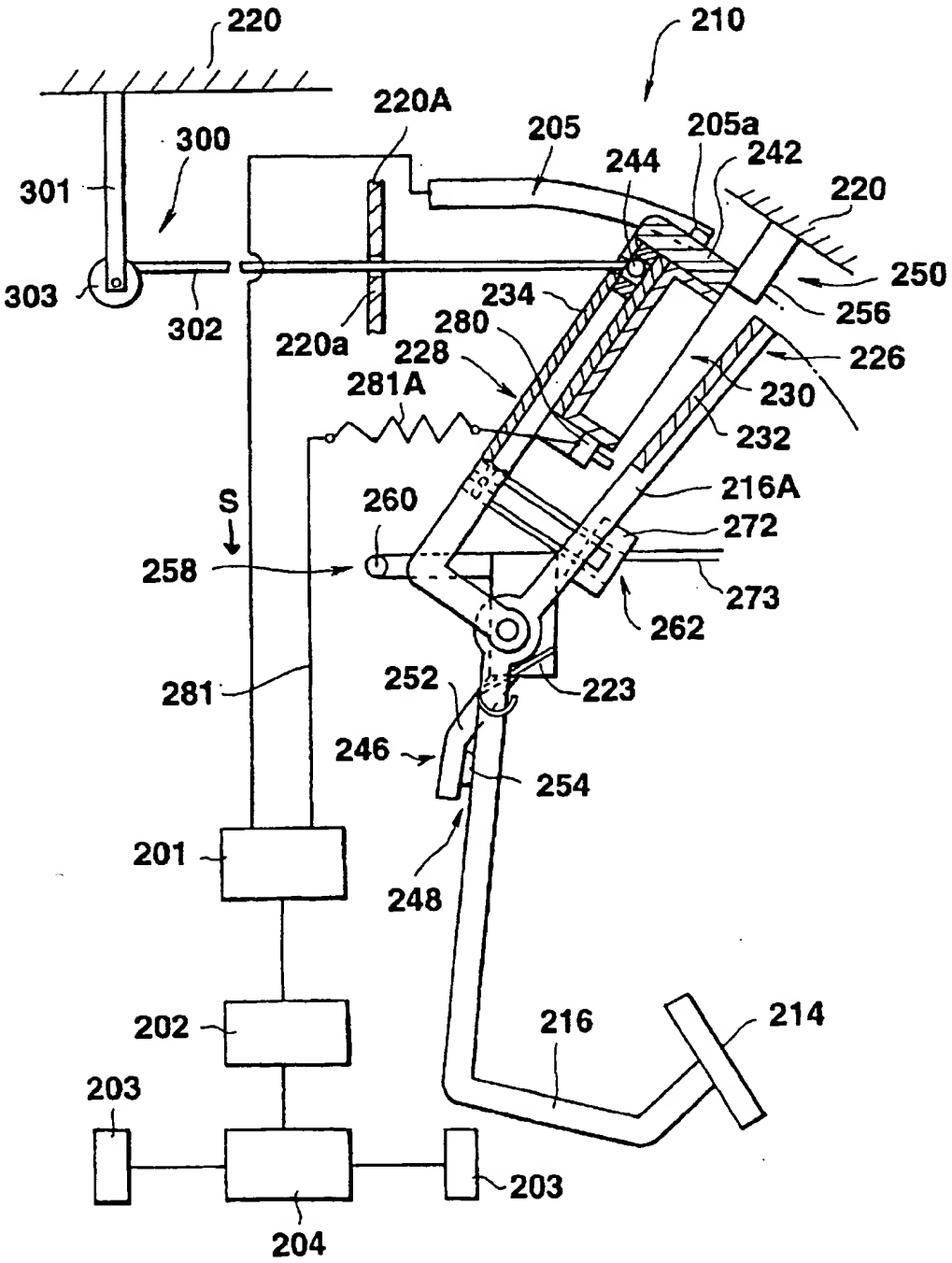
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FIG. 28

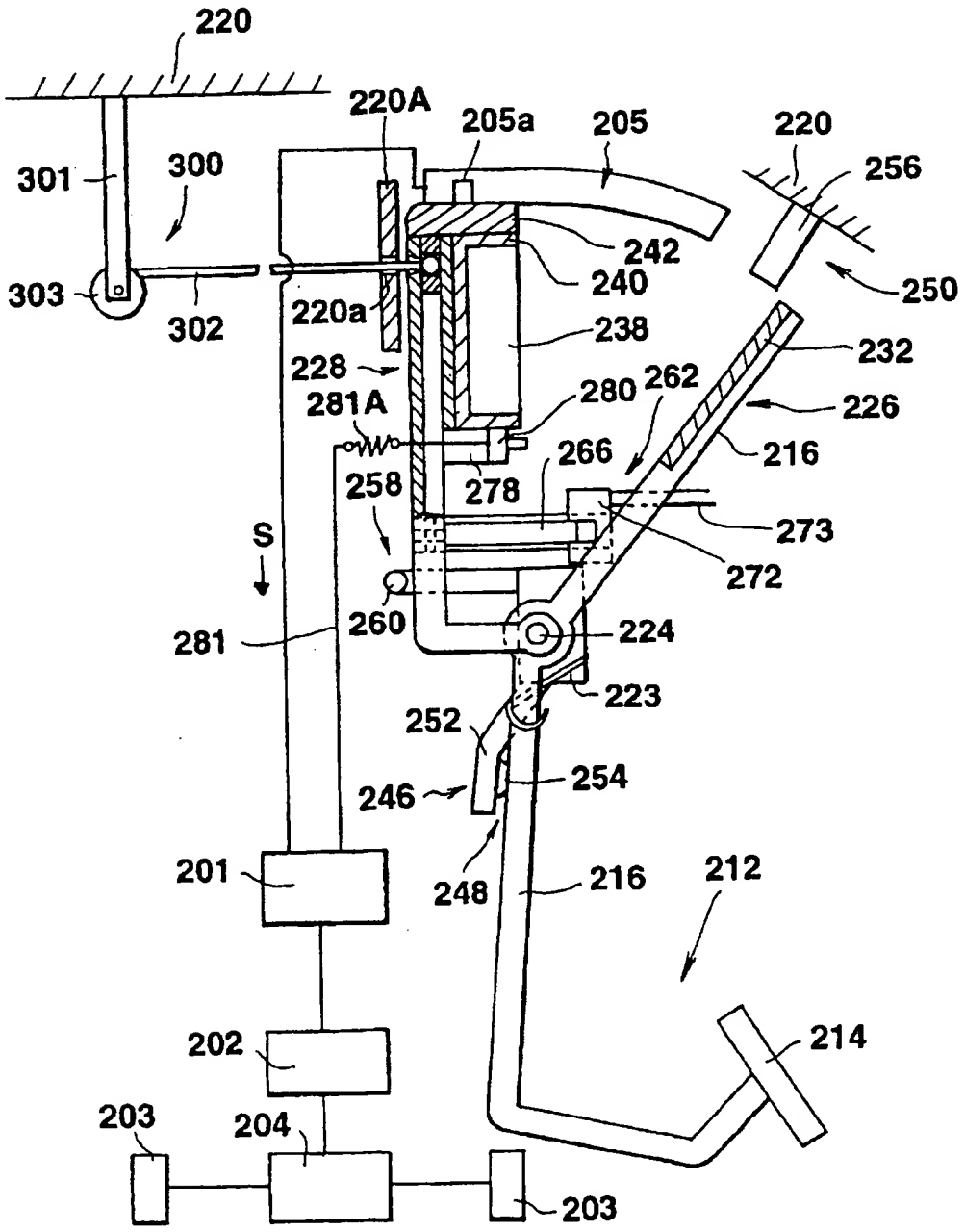
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FIG. 29

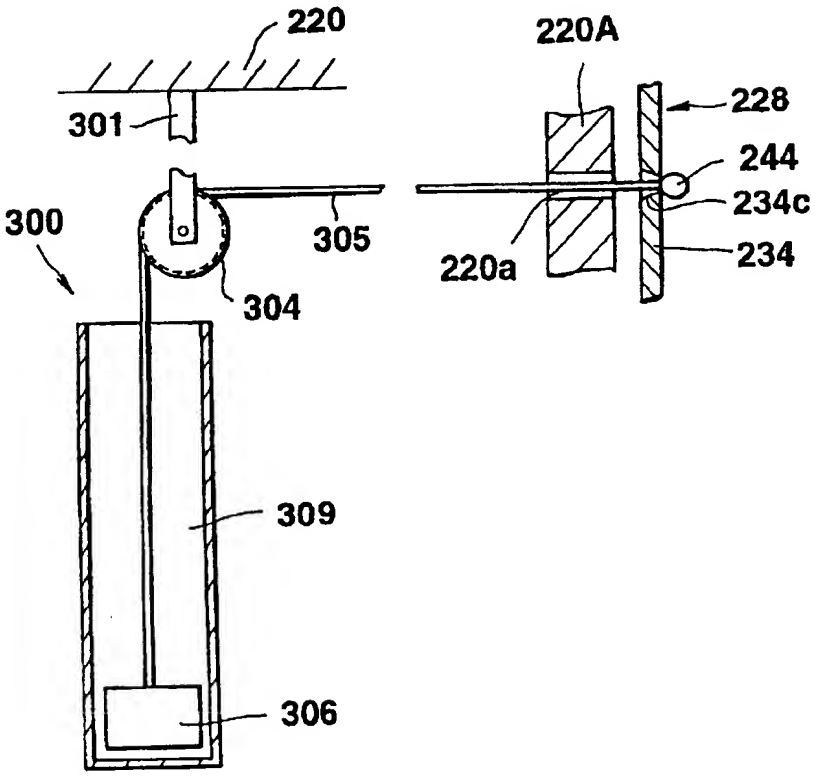
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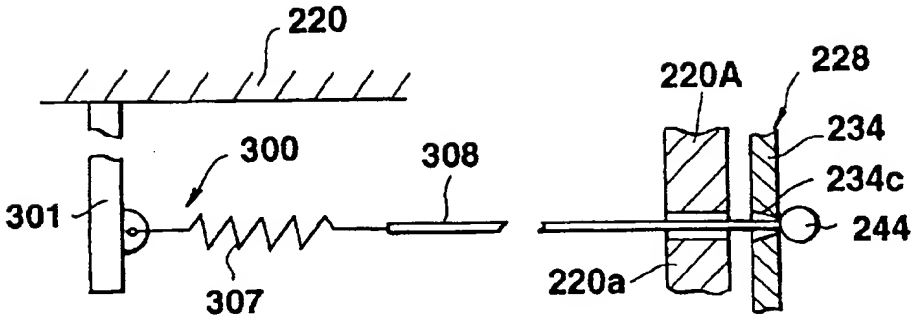
FIG. 30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DEVICE FOR PREVENTING AN ACCELERATOR OF A VEHICLE FROM BEING ERRONEOUSLY OPERATED

TECHNICAL FIELD

This invention pertains to a device for preventing an accelerator of a vehicle such as a gasoline engine automobile or an electric vehicle having an automatic transmission from being erroneously operated. This is done by stopping an accelerating operation when the accelerator pedal is erroneously pushed down in order to prevent the vehicle from being accelerated even though the accelerator pedal is pushed down in spite of the vehicle being intended to be braked.

BACKGROUND OF THE INVENTION

On operating a vehicle such as a gasoline engine vehicle having an automatic transmission mounted thereon, when an accelerator pedal is erroneously pushed down even though a brake pedal is intended to be pushed down for braking the vehicle, it is not stopped, but is accelerated, which should be avoided.

Various devices have been proposed in order to avoid the vehicle from being unwillingly accelerated by an erroneous operation of the pedal. The prior art devices are adapted to basically prevent the vehicle from being accelerated by a fuel system, an air intake system or an ignition system of an engine failing to be operated, which is instructed by an electric signal which is in turn generated by electrically detecting that the accelerator pedal in place of a brake pedal is erroneously pushed down.

For example, Japanese Laying-Open No. 190.135/1986 (Japan 61-190.135), Japanese Laying-Open No. 115.734/1989 (Japan 1-115.734) or Japanese Laying-Open No. 139.183/1993 (Japan 5-139.183) discloses a device adapted to fail to operate one of the aforementioned systems of the engine, which is instructed by an electric signal generated by determining and electrically detecting an erroneous operation of the accelerator pedal in place of the brake pedal when a pedalling force of the accelerator or a pedalling velocity thereof considerably exceeds a normal value.

However, since such prior art devices electrically detect the erroneous operation of the pedal and thereafter prevent an engine from being accelerated in accordance with the electric signal, they disadvantageously have a time delay after the accelerator pedal is pushed down until the engine is prevented from being accelerated. Since the prior art devices require erroneous operation detecting means to determine the erroneous operation of the pedal to generate the electric signal and engine operation disabling means to make the fuel system, the air intake system or the ignition system of the engine disabled in accordance with the electric signal from the erroneous operation detecting means, the construction of the devices is complicated. Furthermore, if the air intake system or the ignition system is disabled while the accelerator pedal continues to be pushed down, then raw gas is undesirably exhausted from the engine. In addition thereto, since the engine is stopped, the engine continues to be stopped even though the accelerator pedal is released and therefore, the vehicle cannot be driven unless the engine is again started.

Japanese Laying-Open No. 185862/1993 (Japan 5-185862) discloses a device for preventing an engine from being accelerated. Normal operation of the accelerator is provided by interengaging an accelerator rod on which an accelerator pedal is mounted with a cable operating plate

connected to a throttle cable so that the accelerator rod is interlocked with the throttle cable, and the engine is prevented from being accelerated by disengaging the accelerator rod from the cable operating plate so that the throttle cable is released from the accelerator rod.

Although the prior art device of Japanese Laying-Open No. 185862/1993 releases the throttle cable from the accelerator pedal in accordance with the erroneous operation of the accelerator pedal in place of the brake pedal, the engine tends to be prevented in a delay time from being accelerated because the accelerator erroneous operation preventing device is never operated unless the accelerator pedal is pushed down while the distance for which the accelerator pedal is pushed down exceeds a predetermined value. Also, the accelerator rod is unstably interlocked with the cable operating plate during the normal operation of the accelerator. Particularly, if the device is so constructed that the accelerator rod is easily again engaged with the cable operating plate in order to return the normal operation of the accelerator after the cable operation plate is released from the accelerator rod, then both of the accelerator rod and the cable operating plate tend to be more unstably interlocked with each other.

On operating the vehicle having an automatic transmission mounted thereon, the accelerator pedal is sometimes erroneously and abruptly pushed down in spite of a brake being intended to be operated while a driver operates the vehicle without contacting the accelerator pedal. In any of the aforementioned prior art arrangements, such erroneous operation of the accelerator causes the throttle cable to be pulled so that a throttle valve is opened in a direction in which the engine is accelerated, and thereafter, the throttle cable is released so that the throttle valve is closed. This causes the engine to be prevented during a time delay from being accelerated.

An electric vehicle is driven by controlling a drive motor which rotates and drives wheels by a controller. The speed of the electric vehicle is conventionally controlled by supplying to the controller a speed control signal generated in association with an accelerator pedal. If the accelerator pedal is erroneously pushed down in place of the brake pedal, the speed control signal indicating acceleration is supplied to the controller. Thus, the electric vehicle is driven at higher speed rather than braked because the drive motor is accelerated.

Accordingly, it is one object of the invention to provide a device for preventing an erroneous operation of an accelerator for a vehicle adapted to not accelerate the vehicle even though the accelerator pedal is erroneously pushed down in spite of a brake pedal being intended to be pushed down. The device is adapted to immediately stop the erroneous operation of the accelerator without time delay when the erroneous operation of the accelerator is detected.

It is another object of the invention to provide a device for preventing an erroneous operation of an accelerator for a vehicle adapted to immediately stop the accelerating operation when the accelerator pedal is erroneously further pushed down in spite of a brake pedal being intended to be pushed down while a driver operates the vehicle with the accelerator pedal being pushed down.

It is a further object of the invention to provide a device for preventing an erroneous operation of an accelerator for a vehicle adapted to immediately stop the accelerating operation without having almost any condition of pushing down the accelerator pedal in an accelerating direction even though the accelerator pedal is erroneously pushed down in spite of a brake pedal being intended to be pushed down

while a driver operates the vehicle without contacting the accelerator pedal.

It is a further object of the invention to provide a device for preventing an erroneous operation of an accelerator for a vehicle adapted to normally operate the vehicle as soon as the accelerator pedal is released from a foot of the driver to immediately return the original condition of the accelerator system after the erroneous operation of the accelerator is prevented.

It is a further object of the invention to provide a device for preventing an erroneous operation of an accelerator for an electric vehicle adapted to immediately stop the accelerating operation when the accelerator pedal is erroneously pushed down in spite of a brake being intended to be pushed down.

DISCLOSURE OF THE INVENTION

A first feature of the invention is to provide magnetic coupling means comprising an accelerator interlocking member interlocking with an accelerator pedal of a vehicle and a throttle interlocking member associated with a throttle valve so as to open and close the throttle valve and being magnetically coupled with the accelerator interlocking member. The magnetic coupling means is magnetically set or arranged so that the accelerator interlocking member is released from the throttle interlocking member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to the accelerator pedal.

Either of the accelerator interlocking member and the throttle interlocking member for the magnetic coupling means may include magnetic material while the other may include a magnet, but both of the accelerator interlocking member and the throttle interlocking member may comprise a magnet. Preferably, the accelerator interlocking member may include an attraction plate of magnetic material while the throttle interlocking member may include a magnet facing to the attraction plate and serving to magnetically attract the attraction plate. The magnetic coupling means is preferably provided on an accelerator arm pivotally mounted on a body of the vehicle and having the accelerator pedal mounted thereon so that the magnetic coupling means is positioned on the side of the accelerator arm opposite to the accelerator pedal relative to a pivotal point of the accelerator arm.

When a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to the accelerator pedal in spite of a brake being intended to be applied on a vehicle having an automatic transmission mounted thereon when it is driven without contacting the accelerator pedal, a mass of the throttle interlocking member and an urging force applied to the throttle interlocking member through a throttle cable serve to resist movement of the throttle interlocking member in an accelerating direction. Also, the leverage of the accelerating arm serves to separately release the accelerator interlocking member from the throttle interlocking member sequentially toward the pivotal point of the accelerator arm from a point of the accelerator interlocking member remote therefrom. Thus, the accelerator interlocking member is immediately moved far away from the throttle interlocking member and the accelerator interlocking member moves in association with the accelerator pedal while the throttle interlocking member is kept at its original position. This prevents a part such as a throttle cable or the like, interlocking a throttle valve with a throttle interlocking member from being pulled so that the throttle valve is opened, and therefore the accelerator from being operated.

A second feature of the invention is to provide magnetic coupling means comprising an accelerator interlocking member interlocking with an accelerator pedal of a vehicle and a throttle interlocking member associated with a throttle valve so as to open and close the throttle valve, the interlocking members being magnetically coupled, and stop means are provided to be engaged against the throttle interlocking member at the pedalling position of the accelerator where the accelerator interlocking member exceeds the furthermost pedalling position of the normal accelerating operation to release the accelerator interlocking member from being magnetically coupled with the throttle interlocking member.

Also, in this magnetic coupling means, either of the accelerator interlocking member and the throttle interlocking member may include magnetic material while the other may include a magnet, but both of them may include a magnet.

The stop means may comprise a first stop member to stop further pushing down the accelerator pedal in the normal operation of the accelerator and a second stop member serving to stop movement of the throttle interlocking member in the accelerating direction so that it is released from the condition of being magnetically coupled with the accelerator interlocking member when the accelerator pedal is pushed down beyond the normal accelerating operation while the first stop member is deformed. The first stop member may be formed of resilient material such as hard rubber or the like which is deformed by pushing down the accelerator pedal beyond the normal accelerating operation, or it may be formed of plastically deformable material such as hard glass or the like which is plastically deformed to allow the accelerator interlocking member to be moved to a position where the accelerator interlocking member is released from being magnetically coupled with the throttle interlocking member by pushing down the accelerator pedal beyond the normal accelerating operation.

While the accelerator is normally operated, even though the accelerator pedal is furthermost pushed down, the part on the side of the accelerator interlocking member is engaged against the first stop member so that the accelerator is normally operated. While the accelerator is normally operated like this, the accelerator pedal sometimes continues to be erroneously pushed down with a pedalling force equal to or more than the pedalling force applied to the brake pedal in spite of the brake pedal being intended to be operated. In such a case, the part on the side of the accelerator interlocking member is firstly engaged against the first stop member, but when the accelerator pedal is strongly pushed down in the same manner as the brake pedal, the first stop member is deformed until the accelerator interlocking member is moved beyond the second stop member. Thus, since the throttle interlocking member is stopped by the second stop member and cannot be moved beyond it, the accelerator interlocking member moves beyond the second stop member with the throttle interlocking member being left at the second stop member while the accelerator interlocking member is released from being magnetically coupled with the throttle interlocking member. Since the throttle interlocking member is returned to the position where the accelerator is released, which is caused by the throttle cable or the like connected to the throttle valve and being urged so that the throttle valve is normally closed, an erroneous operation of the accelerator can be prevented.

The magnetic coupling means of the second feature of the invention may be so magnetically set that the accelerator interlocking member is released from the throttle interlock-

ing member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to the accelerator pedal in the same manner as the magnetic coupling means of the first feature of the invention.

In the same manner as in the first feature of the invention, when the pedalling force equal to or more than the pedalling force applied to the brake pedal is abruptly applied to the accelerator pedal in spite of a brake being intended to be applied on a vehicle having an automatic transmission mounted thereon when it is driven without contacting the accelerating pedal, the accelerator interlocking member is immediately released from the throttle interlocking member, which is based on a mass of the throttle interlocking member, an urging force applied thereto and a principle of leverage acting to the accelerator arm and therefore the accelerator is prevented from being operated.

In either of the first and second features of the invention, if there is not required a function of preventing the erroneous operation of the accelerator, then the accelerator interlocking member may be locked with the throttle interlocking member so that both of them are never released from the magnetic coupling condition.

In either of the first and second features of the invention, at the same time when the accelerator interlocking member and the throttle interlocking member are released from the magnetic coupling condition so as to prevent the erroneous operation of the accelerator, switch means may electrically detect that the accelerator interlocking member and the throttle interlocking member are released from the magnetic coupling condition and thereby the erroneous operation of the accelerator may be warned in accordance with the accelerator erroneous operation signal. A warning may be preferably a speech of "Please release a foot from the accelerator pedal." or the like from a speech synthesis system as well as a warning sound from a buzzer or the like.

A third feature of the invention is to provide magnetic coupling sensor means comprising an accelerator interlocking member interlocking with an accelerator pedal of an electric vehicle, a follower member magnetically coupled with the accelerator pedal while urged to be moved in a direction opposite to an accelerating direction of an accelerator arm to be moved following the accelerator interlocking member and a switching element to detect when the accelerator interlocking member and the follower member are released from the magnetic coupling condition to generate an accelerator erroneous operation signal. The magnetic coupling sensor means is so magnetically set that the accelerator interlocking member is released from the follower member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to the accelerator pedal and is connected to a controller of the electric vehicle so that the accelerator erroneous operation signal from the switching element serves to prevent the controller from controlling the vehicle in an accelerating direction thereof.

Either of the accelerator interlocking member and the follower member for the magnetic coupling sensor means may include magnetic material while the other may include a magnet, but both of them may comprise a magnet. Preferably, the accelerator interlocking member may include an attraction plate of magnetic material while the follower member may include a magnet facing to the attraction plate and serving to magnetically attract the attraction plate. The magnetic coupling sensor means may be preferably provided on the accelerator arm pivotally mounted on a body of the vehicle and having the accelerator pedal so that the magnetic coupling sensor means is positioned on the side of the accelerator arm opposite to the accelerator pedal relative to a pivotal point of the accelerator arm.

When the pedalling force equal to or more than the pedalling force applied to the brake pedal is erroneously and abruptly applied to the accelerator pedal in spite of the electric vehicle being intended to be braked when it is driven without contacting the accelerator pedal, the accelerator interlocking member is immediately released from the follower member and therefore the switching element generates the accelerator erroneous operation signal, which causes the controller of the electric vehicle to stop controlling the vehicle in the accelerating direction in the same manner as described in details with respect to the first feature of the invention.

The fourth feature of the invention is to provide stop means to stop the follower member from moving to the accelerator pedalling position where the accelerator interlocking member exceeds the pedalling position of the normal accelerator operation to release the accelerator interlocking member from being magnetically coupled with the follower member in addition to the same magnetic coupling sensor means as in the third feature of the invention.

The stop means may comprise a first stop member to stop further pushing down the accelerator pedal in the normal accelerating operation and a second stop member serving to stop moving the follower member in the accelerating direction so that it is released from the condition of being magnetically coupled with the accelerator interlocking member when the accelerator pedal is pushed down beyond the normal accelerating operation while the first stop member is deformed. The first stop member may be formed of resilient material such as hard rubber or the like that is deformed by pushing down the accelerator pedal beyond the normal accelerating operation or may be formed of plastically deformable material such as hard glass or the like that is plastically deformed to allow the accelerator interlocking member to be moved to a position where the accelerator interlocking member is released from being magnetically coupled with the follower member by pushing down the accelerator pedal beyond the normal accelerating operation.

While the accelerator is normally operated, even though the accelerator pedal is furthermost pushed down, the part on the side of the accelerator interlocking member is never strongly engaged against the first stop member so that the normal operation of the accelerator is allowed. While the accelerator is normally operated like this, if the accelerator pedal sometimes continues to be operated with the pedalling force equal to or more than the pedalling force applied to the brake pedal in spite of the brake pedal being intended to be operated, then the part on the side of the accelerator interlocking member is first engaged against the first stop member with an abnormal force. Thus, only the accelerating interlocking member moves while the follower member is left and therefore it is released from being magnetically coupled with the follower member to generate the accelerator erroneous operation signal from the switching element. Accordingly, the controller never controls the vehicle in the accelerating direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of an accelerator system having a device for preventing an accelerator from being erroneously operated in accordance with a first embodiment of the invention, with a portion thereof taken in section; FIG. 2 is a front view of the accelerator system of FIG. 1; FIG.

3 is a side elevational view of the accelerator system having the device of FIG. 1 moved to the furthermost pedalling position of a normal operation of the accelerator, with a portion taken in section as in FIG. 1; FIG. 4 is a side elevational view of the accelerator system having the device of FIG. 1 moved beyond the furthermost pedalling position of a normal operation of the accelerator to release the magnetic coupling means, with a portion taken in section as in FIG. 1; FIG. 5 is a side elevational view of the accelerator system having the device of FIG. 1, an accelerator interlocking member of which is moved in association with an accelerator pedal while a throttle interlocking member is left at the original position by abruptly and erroneously pushing down the accelerator pedal in place of a brake pedal, with a portion taken in section as in FIG. 1; FIG. 6 is an enlarged sectional view of an extending hole in a cable holder through which a throttle cable extends; FIG. 7 is an enlarged front view of lock means used for the device of FIGS. 1 through 5, as viewed from the right side of FIG. 1; FIG. 8A is a top view of the lock means of FIG. 7, as rotated 90° counterclockwise and with a portion taken in horizontal section; FIG. 8B is a side elevational view of a locking arm taken along a line B—B of FIG. 8A; FIG. 9 is a side elevational view of an accelerator system having a device for preventing an accelerator from being erroneously operated in accordance with a second embodiment of the invention, with a portion thereof taken in section; FIG. 10 is an enlarged side elevational view of a portion of the device of FIG. 9 having a connecting rod to connect an accelerator arm and an accelerator interlocking member to each other and relative components thereof; FIG. 11 is a front view of an interior of a casing used for the device of FIG. 9 taken along a line 11—11 of FIG. 9; FIG. 12 is a side elevational view of the accelerator system having the device of FIG. 9 moved to the furthermost pedalling position of a normal operation of the accelerator, with a portion taken in section as in FIG. 9; FIG. 13 is a side elevational view of the accelerator system having the device of FIG. 9 erroneously moved beyond the furthermost pedalling position of a normal operation of the accelerator in spite of a brake pedal being pushed down to release the magnetic coupling means, with a portion taken in section as in FIG. 9; FIG. 14 is a side elevational view of the accelerator system having the device of FIG. 9, an accelerator interlocking member of which is moved in association with an accelerator pedal while a throttle interlocking member is left at the original position by abruptly and erroneously pushing down the accelerator pedal in place of the brake pedal, with a portion taken in section as in FIG. 9; FIG. 15 is a side view of an accelerator system having a device for preventing an accelerator from being erroneously operated in accordance with a third embodiment of the invention, with a portion thereof taken in section; FIG. 16 is a front view of the accelerator system of FIG. 15; FIG. 17 is a side elevational view of the accelerator system having the device of FIG. 15 moved to the furthermost pedalling position of a normal operation of the accelerator, with a portion taken in section as in FIG. 15; FIG. 18 is a side elevational view of the accelerator system having the device of FIG. 15 moved beyond the furthermost pedalling position of a normal operation of the accelerator to release the magnetic coupling means, with a portion taken in section as in FIG. 15; FIG. 19 is a side elevational view of the accelerator system having the device of FIG. 15, an accelerator interlocking member of which is moved in association with an accelerator pedal while a throttle interlocking member is left at the original position by abruptly and erroneously pushing down the accelerator pedal in place of a brake pedal, with a portion taken in section as in FIG. 15; FIG. 20 is a side elevational view of an accelerator system having a device for preventing an accelerator from being erroneously operated in accordance with a fourth embodiment of the invention; FIG. 21 is a top view of the accelerator system of FIG. 20; FIG. 22 is a side elevational view of the accelerator system having the device of FIG. 20 erroneously moved beyond the furthermost pedalling position of a normal operation of the accelerator in place of a brake to release the magnetic coupling means; FIG. 23 is a side elevational view of the accelerator system having the device of FIG. 15, an accelerator interlocking member of which is moved in association with an accelerator pedal while a throttle interlocking member is left at the original position by abruptly and erroneously pushing down the accelerator pedal in place of a brake pedal; FIG. 24 is a side elevational view of the accelerator system of FIG. 20 similar to FIG. 20, but with lock means being locked; FIG. 25 is an enlarged sectional view of lock means used for the embodiment of FIGS. 20 through 24; FIG. 26 is a schematic diagram of a device for preventing from being erroneously operated in accordance with an embodiment applied to an electric vehicle, with a main portion thereof partially taken in section; FIG. 27 is a schematic diagram of the device of FIG. 26 having an accelerator pedal in place of a brake pedal being erroneously and abruptly pushed down beyond the furthermost pedalling position of a normal operation of the accelerator and therefore an accelerator interlocking member moved in association with the accelerator pedal while a follower member is left at the original position; FIG. 28 is a schematic diagram of the device of FIG. 26 in which the accelerator pedal has been erroneously moved beyond the furthermost normal pedalling position to cause release of a magnetic coupling sensor; FIG. 29 is an enlarged sectional view of urging means to urge the follower member in a direction opposite to a pedalling direction of the accelerator in accordance with an example different from that of FIG. 26; FIG. 30 is an enlarged sectional view of urging means to urge the follower member in a direction opposite to a pedalling direction of the accelerator in accordance with an example further different from that of FIG. 26; and FIG. 31 is a perspective view of a modification of the first stop member used for the invention.

DETAILED DESCRIPTION OF THE INVENTION

Some preferred embodiments of the invention will be described in detail with reference to the accompanying drawings.

A typical embodiment (a first embodiment) of the invention is shown in FIGS. 1 through 8. A gasoline engine motor vehicle to which the invention is applied is in the form of one having an automatic transmission mounted thereon. An accelerator system 12 having a device 10 for preventing an accelerator from being erroneously operated in accordance with the embodiment of the invention comprises an accelerator arm 16 having an accelerator pedal 14 mounted on and connected to a throttle cable 18, which serves to open and close a throttle valve (not shown) through the accelerator erroneous operation preventing device 10 of the invention.

As conventional, the throttle cable 18 comprises an outer case 18A having its end secured to wall 20A of a vehicle body 20 and a cable body 18B slidably disposed within the outer case 18A. The cable body 18B is urged by a spring (not shown) or the like in a leftward direction as viewed in FIG. 1 so as to normally close the throttle valve. The accelerator

arm 16 is in the form of lever pivotally mounted by a support shaft 24 on a base 22 which is in turn secured to a portion of the vehicle body 20 by suitable means.

As shown in FIG. 2, a coil spring 23 is wound around the portion of the support shaft 24 extending through the base 22. One of ends of the coil spring 23 may be hooked on the base 22 while the other end of the coil spring 23 may be hooked on a rear face of the accelerator arm 16 (a lefthand face of FIG. 1). Thus, the accelerator pedal 14 is urged in an upward direction as viewed in FIG. 1.

The accelerator erroneous operation preventing device 10 constructed in accordance with the first embodiment of the invention is provided with magnetic coupling means 30 comprising an accelerator interlocking member 26 mounted on the accelerator arm 16 and a throttle interlocking member 28 associated with the throttle valve so as to open and close the throttle valve and being magnetically coupled with the accelerator interlocking member 26.

In the illustrated embodiment, the magnetic coupling means 30 may be provided on a portion (an upper half portion) 16A of the accelerator arm 16 opposite to the accelerator pedal 14 relative to the pivotal point (a position where the accelerator arm 16 is supported) of the accelerator arm 16. This advantageously causes a principle of leverage of the magnetic coupling means 30 to act as described with reference to the operation of the device of the invention. Also, in the illustrated embodiment, as shown in FIGS. 1 and 2, the accelerator interlocking member 26 may comprise an attraction plate 32 of magnetic material such as iron or the like mounted by welding or the like on an end (a free end) 16*a* of the upper half portion 16A of the accelerator arm 16 at the back face thereof (a lefthand face of FIG. 1) so as to extend while crossing the accelerator arm 16. The throttle interlocking member 28 may comprise a cable holder 34 of channel steel at a lower horizontal portion 35 thereof pivotally supported by the support shaft 24 and having a length corresponding to that of the upper half portion 16A of the accelerator arm 16. A magnet mount plate 36 is secured by welding or the like to a pair of flange walls 34*a* and 34*b* and disposed therebetween so as to face the attraction plate 32 and two permanent magnets 38 are secured to the magnet mount plate 36. The permanent magnets 38 have a magnetic cover 40 of iron adapted to cover the faces of the permanent magnets 38 excluding the face corresponding to the attraction plate 32. The two permanent magnets 38 may be disposed symmetrically on both sides of the accelerator arm 16 relative thereto, respectively. In FIG. 1, reference numeral 42 designates an engaging member secured by welding or the like to the cable holder 34 on its upper face to engage a stop member secured to the vehicle body 20 when the accelerator pedal 14 is moved for more than a predetermined distance as described later. The engaging member 42 serves to prevent the throttle interlocking member 28 from being moved beyond the stop member.

As shown in FIG. 1, the cable body 18B of the throttle cable 18 extends through an extending hole 20*a* in the wall 20A of the vehicle body 20 and an extending hole 34*c* in the cable holder 34. A spherical body holder 44 is securely connected to the front end (the righthand end of FIG. 1) of the cable body 18B and engaged with the cable holder 34 so that the cable body 18B is not drawn out of the cable holder 34. As shown in FIG. 6, the extending hole 34*c* is so tapered that the inner diameter of the extending hole 34*c* is gradually larger and larger toward the inside of the vehicle body (in the leftward direction as viewed in FIG. 1) so that the front end of the cable body 18B is never bent when the magnetic coupling means 30 is pivotally moved about the support shaft 24.

The attraction plate 32 of the accelerator interlocking member 26 of the magnetic coupling means 30 is normally magnetically attracted by the permanent magnets 38 of the throttle interlocking member 28 as shown in FIG. 1 to integrally couple the accelerator interlocking member 26 with the throttle interlocking member 28. Thus, as the accelerator pedal 14 is pushed down or pedalled as shown in FIG. 3, the accelerator interlocking member 26 and the throttle interlocking member 28 of the magnetic coupling means 30 are pivotally moved through the accelerator arm 16 about the support shaft 24 in a clockwise direction as viewed in FIG. 3. Therefore, the cable body 18B of the throttle cable 18 connected to the throttle interlocking member 28 is pulled so that the throttle valve is opened in accordance with the degree of pushing down the accelerator pedal 14.

The magnetic coupling means 30 is so magnetically set that the accelerator interlocking member 26 is released from the throttle interlocking member 28 as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to the accelerator pedal 14. This causes the accelerator arm 16 and the accelerator interlocking member 26 to be pivotally moved while the throttle interlocking member 28 is left at the original position adjacent to the wall 20A of the vehicle body 20 (corresponding to the position of the throttle interlocking member 28 when the accelerator pedal 14 is not pushed down) as shown in FIG. 5 in accordance with an urging force applied to the throttle cable 18 in a leftward direction as viewed in FIG. 1, a mass of the whole throttle interlocking member 28, a leverage of the accelerator arm 16 and a set magnetic force of the permanent magnets 38 before the accelerator interlocking member 26 and the throttle interlocking member 28 coupled with each other by magnetic attraction of the permanent magnets 38 are moved together with each other by the accelerator arm 16. Particularly, since the leverage of the accelerator arm 16 causes the attraction plate 32 to be moved so that it is separated from the permanent magnets 38 sequentially from the upper portion thereof, the accelerator arm 16 having the attraction plate 32 held thereon is easily moved while the permanent magnets 38 are left so as to release the magnetic coupling when the accelerator arm 16 is abruptly pivotally moved in the same manner as the brake pedal is pushed down, but not is slowly pivotally moved in the same manner as in the normal operation of the accelerator.

The device 10 of the invention further comprises stop means 46 to stop the movement of the throttle interlocking member 28 at the accelerator pedalling position where the accelerator interlocking member 26 exceeds the furthermost pedalling position of the normal accelerating operation so that only the accelerator interlocking member 26 further moves to release the accelerator interlocking member 26 from being magnetically coupled with the throttle interlocking member 28.

In the illustrated embodiment, this stop means 46 may comprise a first stop member 48 to stop further pushing down of the accelerator pedal in the normal accelerating operation so as to set the furthermost pedalling distance and a second stop member 50 to be engaged against the engaging member 42 of the throttle interlocking member 28 so that the throttle interlocking member 28 is released from being magnetically coupled with the accelerator interlocking member 26 because the throttle interlocking member 28 never further moves in the accelerating direction while the first stop member 48 is deformed when the accelerator pedal 14 is pushed down beyond the furthermost pedalling distance of the normal accelerating operation.

In the illustrated embodiment, as shown in FIGS. 1 and 2, the first stop member 48 may comprise a stationary extending piece 52 downwardly extending from the base 22 so as to face the accelerator arm 16 and a stop body 54 secured to the stationary extending piece 52. The stop body 54 may be formed of resilient material such as hard rubber or the like being deformed by pushing down the accelerator pedal 14 beyond the furthermost pedalling distance of the normal accelerating operation. Also, it may be formed of a cylindrical body of plastically deformable material such as hard glass or the like as shown in FIG. 31, for instance which is plastically deformed to allow the accelerator arm 16 to be moved by pushing down the accelerator pedal 14 beyond the furthermost pedalling distance of the normal accelerating operation. The cylindrical body may be so disposed as that the front face of the accelerator arm 16 is engaged against the peripheral face of the cylindrical body, but may be preferably so disposed that the accelerator arm 16 is engaged against the longitudinal end face of the cylindrical body. Of course, the stop body 54 of plastically deformable material is not limited to one of cylindrical form.

As shown in FIG. 1, the second stop member 50 may comprise a stop body 56 secured to the vehicle body 20 by any suitable means. The stop body 56 is set at a position where the engaging member 42 of the throttle interlocking member 28 never engages the stop body 56 at the pedalling distance of the normal accelerating operation (see FIG. 3). However, the engaging member 42 of the throttle interlocking member 28 engages the stop body 56 as the accelerator arm 16 is moved beyond the furthermost pedalling distance of the normal accelerating operation while the first stop member 48 is deformed (see FIG. 4).

In the illustrated embodiment, the first stop member 48 may be so disposed as to face the lower half portion of the accelerator arm 16 on the rear face thereof (the lefthand face of FIG. 1), but may be so disposed as to face the upper half portion 16A of the accelerator arm 16 on the front face thereof (the righthand face of FIG. 1). The second stop member 50 may be disposed at the area of an arc motion about the support shaft 24 of the engaging member 42 mounted on the top of the throttle interlocking member 28, but may be disposed so as to engage the engaging member which is not mounted directly on the throttle interlocking member 28, but on the portion of the cable body 18B exposed out of the outer case 18A so that the cable body 18B of the throttle cable 18 stops at the predetermined position.

As shown in FIGS. 1 and 2, there may be provided position control means 58 to control the position of the throttle interlocking member 28 so as not to further move beyond the position of FIG. 1 in the leftward direction thereof. The position control means 58 may comprise a stop member 60 in the form of rod extending from the base 22 in the rearward direction and then bent so as to engage the rear face of the cable holder 34 of the throttle interlocking member 28.

The accelerator erroneous operation preventing device 10 of the invention may further comprise lock means 62 to lock the accelerator interlocking member 26 with the throttle interlocking member 28 so that they are never released from the magnetic coupling condition when the function of preventing the accelerator from being erroneously operated is not required.

An example of the lock means 62 is shown in FIGS. 7, 8A and 8B. The lock means 62 may comprise a lock arm 66 pivotally supported on a bracket 64 mounted on the side of the cable holder 34 at a supporting hole 64*a* thereof as shown in FIG. 8A and an actuator 68 to drive the lock arm 66 between a locking position and a lock releasing position. The lock arm 66 is mounted on the inner wall face of the support hole 64*a* in the bracket 64 and held by a spring 70 engaging the inner face of the lock arm 66 so as to release the lock means from the locking position (see FIG. 8A). The actuator 68 may comprise a pushing type linear solenoid 72 mounted on an extension 64A extending from the bracket 64 as shown in FIG. 8A with a pushing rod 72*b* integrally provided on an armature 72*a* engaging a free end of the lock arm 66.

Thus, the lock arm 66 is normally positioned so as to be released from the locking condition by the spring 70, and therefore the accelerator erroneous operation preventing device 10 can prevent the accelerator from being erroneously operated as described in detail later. However, when the linear solenoid 72 is energized, the armature 72*a* is magnetically attracted in the downward direction as viewed in FIG. 8A so that the pushing rod 72*b* pushes the lock arm 66 against the spring 70 with a leading hook portion 66*a* of the lock arm 66 hooked on the accelerator arm 16 as indicated by a dotted line of FIG. 8A. Thus, the accelerator interlocking member 26 and the throttle interlocking member 28 of the magnetic coupling means 30 are never released from the magnetic coupling condition so that the accelerator arm 16 is effectively integral with the throttle cable 18. In FIG. 1, reference numeral 74 designates a switch provided on a driver panel and connected through a lead wire 73 between a battery 75 and the linear solenoid 72 so that the linear solenoid 72 is energized or disenergized.

The accelerator erroneous operation preventing device 10 of the invention may further comprise erroneous operation warning means 76 to warn to a driver that the accelerator is erroneously operated. As shown in FIG. 1, this erroneous operation warning means 76 may comprise a switching element 80 held on a support 78 which is in turn secured by welding or the like to the flange walls 34*a* and 34*b* of the cable holder 34 so as to face the rear face of the upper half portion 16A of the accelerator arm 16 and a warning circuit 82 connected through a lead wire 81 to the switching element 80 and to be driven thereby. The warning circuit 82 is omitted in FIGS. 2 through 5.

The warning circuit 82 may preferably include a speech synthesis system 82B issuing a speech of "Please release the foot from the pedal" or the like, for example as well as a warning device 82A such as a buzzer or the like. There may be provided a lead wire elastic portion 81A at a portion of the lead wire 81 to allow the lead wire 81 to be expanded and contracted when the throttle interlocking member 28 together with the switching element 80 is pivotally moved about the support shaft 24.

An operation of the device of the invention will be described with reference to FIGS. 1 through 5, the lock means 62 is normally positioned to be released from the lock condition as aforementioned. Also, the accelerator interlocking member 26 and the throttle interlocking member 28 are normally integral to each other by magnetically coupling the permanent magnet 38 with the attraction plate 32.

Accordingly, when the accelerator pedal 14 is pushed down with the normal operation of the accelerator, the accelerator arm 16 serves to pull the throttle cable 18 from the condition of FIG. 1 to the condition of FIG. 3 in case of the accelerator pedal is furthermost pushed down to open the throttle valve to increase the revolution speed of the engine and the running speed of the vehicle. Even when the accelerator pedal 14 is pushed down for the furthermost

pedalling distance, the accelerator arm **16** engages the first stop member **48** of the stop means **46** and therefore the accelerator arm **16** is not moved further. Since the normal operation of the accelerator is by relatively slowly pushing down or releasing the accelerator pedal **14**, the magnetic coupling condition of the magnetic coupling means **30** is never released. Also, since abrupt acceleration on passing another vehicle will be made in the condition of pushing down the accelerator by some degree, the accelerator arm **16** is moved in the accelerating direction while the magnetic coupling condition of the magnetic coupling means **30** is maintained, but since the pedalling distance thereof never reaches the degree by which the accelerator arm **16** deforms the first stop member **48**, the coupling condition of the attraction plate **32** and the permanent magnets **38** of the magnetic coupling means **30** is never released by the condition of pushing down the accelerator pedal.

In the motor vehicle having the automatic transmission mounted thereon, a driver sometimes operates while the accelerator pedal **14** is released from the foot. On such a condition, the accelerator pedal **14** is sometimes erroneously pushed down in spite of the brake pedal being intended to be pushed down. In this case, as a pedalling force equal to or more than the pedalling force to be applied to the brake pedal is applied to the accelerator pedal **14**, the magnetic coupling means **30** is released from the coupling condition thereof because it is so magnetically set to immediately release the accelerator interlocking member **26** from the throttle interlocking member **28** by such abrupt operation of the accelerator pedal **14**. More particularly, before the throttle interlocking member **28** is moved together with the accelerator interlocking member **26** through the accelerator arm **16** by pushing down the accelerator pedal **14**, the accelerator arm **16** and the accelerator interlocking member **26** are pivotally moved in accordance with the pedalling distance of the accelerator pedal **14** while the throttle interlocking member **28** is left at the original position as shown in FIG. **5**, which is caused by the urging force applied to the throttle cable **18**, the mass of the whole throttle interlocking member **28**, the leverage of the accelerator arm **16** and the set magnetic force of the permanent magnets **38**. Since the leverage of the accelerator arm **16** causes the attraction plate **32** to be moved so that it is separated from the permanent magnets **38** sequentially from the upper portion thereof, when the accelerator arm **16** is pivotally moved not slowly as in the normal operation of the accelerator, but abruptly as in the erroneous operation of the accelerator in place of the brake, the accelerator arm **16** having the attraction plate **32** held thereon is more easily moved while the permanent magnets **38** are left to release the magnetic coupling condition of the magnetic coupling means **30**.

Accordingly, in spite of the accelerator pedal **14** being pushed down, the throttle cable **18** is hardly pulled as shown in FIG. **5** and therefore the vehicle is never accelerated. This means that the accelerator can be prevented without any time delay from being erroneously operated because the accelerator pedal **14** is disconnected from the throttle cable **18** at the same time when the accelerator erroneous operation is detected.

Next, in case that the vehicle is driven while the accelerator is normally operated with the foot contacting the accelerator pedal **14**, the accelerator pedal **14** is sometimes pushed down with the pedalling force equal to or more than the pedalling force applied to the brake pedal. In this case, the accelerator arm **16** provided on the side of the accelerator interlocking member **26** engages the first stop member **4**, but as the accelerator pedal **14** is erroneously strongly pushed down in place of the brake pedal, the attraction plate **32** of the accelerator interlocking member **26** moves beyond the second stop member **50** while the resilient stop body **54** is deformed as shown in FIG. **4**. On the other hand, since the engaging member **42** of the throttle interlocking member **26** engages the second stop member **50** so as not to move beyond the second stop member **50**, the attraction plate **32** of the accelerator interlocking member **26** is released from being magnetically coupled with the permanent magnets **38** of the throttle interlocking member **28** so as to move beyond the second stop member **50** while the throttle interlocking member **28** is left at the second stop member **50**. The throttle interlocking member **28** is immediately returned to the accelerator releasing position by the throttle cable **18** connected to the throttle valve and normally urged by the spring or the like to close the throttle valve, which causes the accelerator to be prevented from being erroneously operated.

In this manner, either in case that abruptly initiating to push down the accelerator pedal **14** causes the magnetic coupling means **30** to be released from the magnetic coupling condition to prevent the accelerator from being erroneously operated, or in case that abruptly pushing down the accelerator pedal **14** in place of the brake pedal during the normal pedalling operation of the accelerator causes the magnetic coupling means **30** to be released from the magnetic coupling condition by the stop means **46** to prevent the accelerator from being erroneously operated, since the switching element **80** of the erroneous operation warning means **76** is closed by moving far away from the accelerator arm **16**, the warning circuit **82** is energized so that the buzzer is driven or the speech of "Please release the foot from the pedal" or the like is issued. Thus, the driver can recognize the erroneous operation of the accelerator. Therefore, the driver can switch from the accelerator pedal to the brake pedal immediately to decelerate or stop the vehicle.

As the driver recognizes the erroneous operation of the accelerator and releases his foot from the accelerator pedal **14**, the accelerator arm **16** is moved by the coil spring **23** so as to again couple the accelerator interlocking member **26** of the magnetic coupling means **30** with the throttle interlocking member **28** thereof. In this manner, since only releasing the foot from the accelerator pedal **14** causes the magnetic coupling means **30** to be returned to the original condition, the accelerator can be again normally operated.

In case that there is required no erroneous operation of the accelerator, the switch **74** of the lock means **62** is closed to energize the linear solenoid **72** so as to magnetically attract the armature **72***a*. This causes the pushing rod **72***b* integral to the armature **72***a* to push the lock arm **66** against the spring **70** from the solid line position of FIG. **8**A to the dotted line position thereof, which causes the end hook portion **66***a* of the lock arm **66** to hook the accelerator arm **16** so that the accelerator interlocking member **26** and the throttle interlocking member **28** are integrally locked with each other. This integrally connects the accelartor arm **16** to the throttle cable **18** so that the vehicle is driven with the normal operation of the accelerator.

The accelerator erroneous operation preventing device **10** of the invention can be manufactured and sold as a unit assembly together with the accelerator pedal **14** and therefore the device of the invention can be easily assembled in the existing vehicles. Since the existing vehicles have the throttle cable **18** connected directly to the accelerator arm **16**, the throttle cable is disconnected from the accelerator arm **16**, the accelerator pedal and the accelerator arm

mounted on the existing vehicle are replaced by the assembly of the device of the invention and the throttle cable **18** is connected to the throttle interlocking member **28** of the device of the invention.

The accelerator erroneous operation preventing device **10** constructed in accordance with another embodiment (a second embodiment) of the invention is shown in FIGS. **9** through **14**. In these figures, the same reference numerals as those in FIGS. **1** through **8** designate the same components.

The device of the second embodiment is substantially identical to that of the first embodiment, except that the magnetic coupling means **30** is disposed within a cylindrical casing **84** which is in turn mounted on the vehicle body (not shown) and there is provided guide means to linearly guide the accelerator interlocking member **26** and the throttle interlocking member **28** of the magnetic coupling means **30** within the casing **84**. Also, the attraction plate **32** of the accelerator interlocking member **26** is not mounted directly on the accelerator arm **16**, but connected to a free end **16***a* of the accelerator arm **16** through a connecting rod **88**.

As shown in FIG. **9**, the casing **84** may comprise crown-like casing halves **84**A and **84**B, which are joined with each other in the form of a socket or faucet. The casing **84** may be formed by containing the magnetic coupling means **30** within the casing **84** and then joining the casing halves **84**A and **84**B by any suitable means.

As shown in FIGS. **9** and **10**, the connecting rod **88** may extend through an extending hole **84***b* in the casing half **84**B of the casing **84** with one end (rear end) thereof pivotally supported by a pin **33** on a fork-like bracket **32***a* of the attraction plate **32** and with the other end (front end) thereof pivotally supported by a pin **17** on a fork-like bracket **16***b* provided on the inner face of the accelerator arm **16** at the free end **16***a* thereof. As shown in FIGS. **12** and **13**, the extending hole **84***b* in the casing half **84**B has the inner diameter enough for the connecting rod **88** to be allowed to be pulled while inclined as the accelerator arm **16** is pivotally moved and for the bracket **32***a* to enter the extending hole **84***b*.

In the illustrated embodiment, the throttle interlocking member **28** may comprise four permanent magnets **38** mounted on the crown-like cable holder **34** in a manner equally spaced in a peripheral direction (see FIG. **11**), and may be covered with the magnetic covers **40** except for the portion facing the attraction plate **32** in the same manner as in the first embodiment. Since the permanent magnets **38** can be mounted directly on the cable holder **34**, the magnet mounting plate **36** for the first embodiment is omitted. The throttle cable **18** extends through the extending hole **84***a* in the casing **84** and through the extending hole **34***c* in the cable holder **34** and connected to the throttle interlocking member **28** as that the throttle cable **18** is prevented from being removed out of the throttle interlocking member **28** by the cable holder **44**. The engaging member **42** of the throttle interlocking member **28** may be in the form of ring mounted on the crown-like cable holder **34** at the inner peripheral end there of while the stop body **56** of the second stop member **50** which the engaging member **42** engages is in the form of a ring mounted on the half **84**B of the casing **84** at the inner periphery thereof. Since the magnetic coupling means **30** linearly moves through the guide means **86**, the extending hole **34***c* may be not tapered as in the first embodiment, but linearly formed.

The guide means **86** may comprise a pair of guide rods **90** and **90'** provided within the casing **84** on both sides of and parallel to the center axis thereof and in parallel to the center axis and extending through the attraction plate **32** and the cable holder **34** so that they are slidably guided. Thus, the accelerator interlocking member **26** and the throttle interlocking member **28** of the magnetic coupling means **30** are linearly guided along the guide rods **90** and **90'**.

As shown in FIGS. **9**, and **12** through **14**, the position control means **58** may comprise a plural of stop members **60** mounted on the portion of the half **84**A of the casing **84** facing to the cable holder **34**. The stop members **60** may be formed of hard rubber, for example.

Since the operation of the accelerator erroneous operation of the accelerator **10** in accordance with the second embodiment is substantially identical to that of the first embodiment, the detailed description thereof will be omitted. However, in the second embodiment, the magnetic coupling means **30** is independent from the pivotal movement of the accelerator arm **16** and linearly guided by the guide means **86**, which is different from the movement of the magnetic coupling means **30** of the first embodiment. Thus, since the leverage of the accelerator arm **16** is not acted to the attraction plate **32** which is magnetically attracted onto the permanent magnets **38**, all the permanent magnets **38** are simultaneously removed away from the attraction plate **32**. Thus, the attracting force of the permanent magnets **38** which is required to initially release the magnetic coupling condition and more particularly to remove the attraction plate **32** far away from the permanent magnets **38** by pushing down the accelerator pedal **14** in place of the brake pedal while the vehicle is driven with the foot being released from the accelerator pedal **14** can be lower than that of the first embodiment. In the illustrated embodiment, since the position where the connecting rod **88** is connected to the accelerator interlocking member **26** and the position where the throttle cable **18** is connected to the throttle interlocking member **28** are located on the center axes of the interlocking members, the leverage of the accelerator arm cannot be used. But, it will be apparent to the those skilled in the art that the positions of connection may be displaced from the center axes so that the leverage can be applied to the magnetic coupling means **30**.

In the second embodiment, FIG. **12** corresponds to FIG. **3** of the first embodiment and illustrates the accelerator pedal to be pushed down to the furthermost pedalling distance while the accelerator is normally operated. FIG. **13** corresponds to FIG. **4** of the first embodiment and illustrates the accelerator pedal **14** to be erroneously in place of the brake pedal from the condition of the accelerator pedal **14** being pushed down, but the accelerator to be prevented from being erroneously operated. FIG. **14** corresponds to FIG. **5** of the first embodiment and illustrates the accelerator pedal **14** to be erroneously in place of the brake pedal from the condition of the foot being released from the accelerator pedal **14**, but the accelerator to be prevented from being erroneously operated.

As in the first embodiment, there may be provided the erroneous operation warning means **76**, only the switching element **80** of which is shown in FIG. **9**. The switching element **80** may be connected to the warning circuit **82** which may be identical to that of the first embodiment. The erroneous operation warning means **76** is shown to be omitted in FIGS. **11** through **14**. Although also omitted in FIGS. **9** through **14**, there may be provided lock means to lock the coupling condition of the magnetic coupling means **30**. The casing **84** may be provided with escaping holes through which parts such as the lock arm for the lock means enter the casing **84** while they are never interfered with the casing **84**.

The accelerator erroneous operation preventing device **10** constructed in accordance with a further embodiment (a third embodiment) of the invention is shown in FIGS. **15** through **19**. In these figures, the same reference numerals as those of FIGS. **1** through **14** designate the same components.

The device of the third embodiment is substantially identical to that of the second embodiment, except that there is provided no cylindrical casing **84** containing the magnetic coupling means **30** and also no guide means to guide the accelerator interlocking member **26** and the throttle interlocking member **28** of the magnetic coupling means **30** and that the attraction plate **32** of the accelerator interlocking member **26** is mounted directly on the accelerator arm **16**.

Accordingly, in the third embodiment, when the accelerator pedal **14** is pushed down on the normal operation of the accelerator, the magnetic coupling means **30** is pivotally moved together with the accelerator arm **16** about the support shaft **24**, in the same manner as in the first embodiment. The stop member **56** is mounted in the area of the vehicle body **20** where the cable holder **34** of the throttle interlocking member **28** is pivotally moved and at the position where the engaging member **42** on the throttle interlocking member **28** engages the stop member **56** when the accelerator arm **16** further moves until the first stop member **48** is deformed after the accelerator arm **16** engages the first stop member **48**. Furthermore, in the same manner as in the first embodiment, the extending hole **34***c* is so tapered that the throttle cable **18** is prevented from being bent at the portion where it extends through the cable holder **34**.

Since the operation of the accelerator erroneous operation preventing device **10** in accordance with the third embodiment is substantially identical to those of the first and second embodiments, the detailed description thereof will be omitted. However, in the third embodiment, the magnetic coupling means **30** is pivotally moved in the same manner as in the first embodiment, which is different from that of the second embodiment. Thus, since the leverage of the accelerator arm **16** is applied to the attraction plate **32** which is magnetically attracted onto the permanent magnets **38**, the attraction plate **32** is pivotally moved while it is separated sequentially from the upperside permanent magnet **38** toward the lowerside permanent magnets **38** when the accelerator pedal **14** is abruptly pushed down in place of the brake pedal from the condition of driving the vehicle with the foot being releasing from the accelerator pedal **14** with the pedalling force equal to or more than the pedalling force applied to the brake pedal. Therefore, only the accelerator interlocking member **26** can be pivotally moved in association with the accelerator pedal **14** without accompanying the throttle interlocking member **28** while it is left at the original position so that the magnetic coupling condition of the magnetic coupling means **30** is released (see FIG. **19**).

In the third embodiment, the condition of FIG. **17** corresponds to those of FIG. **3** of the first embodiment and of FIG. **12** of the second embodiment, the condition of FIG. **18** corresponds to those of FIG. **4** of the first embodiment and of FIG. **13** of the second embodiment and the condition of FIG. **19** corresponds to those of FIG. **5** of the first embodiment and of FIG. **14** of the second embodiment.

As in the first embodiment, there is provided the erroneous operation warning means **76**, only the switching element **80** of which is shown in FIG. **15**. The switching element **80** may be connected to the warning circuit not shown in the same manner as in the first embodiment. The erroneous operation warning means **76** is omitted in FIGS. **16** through **19**. Although also shown to be omitted in FIGS. **15** through **19**, there may be provided lock means to lock the coupling condition of the magnetic coupling means **30**.

The accelerator erroneous operation preventing device **10** constructed in accordance with a further embodiment (a fourth embodiment) of the invention is shown in FIGS. **20** through **25**. In these figures, the same reference numerals as those of FIGS. **1** through **19** designate the same components.

In the fourth embodiment, the magnetic coupling means **30** is provided on the side of the accelerator arm **16** having the accelerator pedal **14** relative to the support shaft **24**, which is different from the first through third embodiments in which the magnetic coupling means **30** is provided on the side of the accelerator arm **16** opposite to the accelerator pedal **14** relative to the support shaft **24**.

The accelerator arm **16** may comprise a throttle interlocking arm portion **92A** pivotally supported on the support shaft **24** and having a free end to which the throttle cable (not shown) is connected and an accelerator interlocking arm portion **92B** pivotally mounted by a pin **94** on the throttle interlocking arm portion **92A** and having the accelerator pedal **14** mounted thereon. As shown in FIG. **21**, a portion **92***b* of the accelerator interlocking arm portion **92B** pivotally mounted on the throttle interlocking arm portion **92A** may be in the form of fork and the fork-like end **92***b* is pivotally mounted by the pin **94** on the throttle interlocking arm portion **92A** so as to be disposed on both sides of the arm portion **92A**.

The magnetic coupling means **30** may be provided between the throttle interlocking arm portion **92A** and the accelerator interlocking arm portion **92B** on the side of accelerator pedal **14** relative to the pin **94** which pivotally supports the arm portions **92A** and **92B**. The magnetic coupling means **30** may comprise a permanent magnet **38** mounted on the throttle interlocking arm portion **92A** and a permanent magnet **38A** mounted on the accelerator interlocking arm portion **92B** so as to face the permanent magnet **38**. Therefore, in the illustrated embodiment, the throttle interlocking arm portion **92A** constitutes the throttle interlocking member **28** while the accelerator interlocking arm portion **92B** constitutes the accelerator interlocking member **26** and the members **26** and **28** are integrally coupled with each other by magnetically attracting them to each other. There may be provided a spring **96** between the throttle interlocking arm portion **92A** and the accelerator interlocking arm portion **92B** to be pulled toward each other in order to urge the accelerator interlocking arm portion **26** and the throttle interlocking arm portion **28** to be normally integrally coupled with each other by magnetically attracting them to each other by means of the permanent magnets **38** and **38A**.

The first stop member **48** of the stop means **46** may comprise a stop body **54** provided on a floor **20B** of the vehicle while the second stop member **50** may comprise a rod-like stop body **56** extending from the throttle interlocking arm portion **92A**. The accelerator interlocking arm portion **92B** engages the stop body **54** of the first stop member **48** at the furthermost pedalling distance of the normal accelerating operation while the stop body **56** of the second stop member **50** engages the floor **20B** when the accelerator interlocking member **26** is further moved downwardly while the stop body **54** of the first stop member **48** is deformed by applying to the accelerator pedal **14** the pedalling force equal to or more than the pedalling force applied to the brake pedal.

As shown in FIGS. **20** and **25**, the lock means **62** may comprise a locking rod **100** integrally provided on the

armature 98a of the linear solenoid 98 which is in turn mounted on the throttle interlocking arm portion 92A at the end thereof opposite to the throttle cable and an engaging member 102 integrally provided on the accelerator interlocking member 92B and having an engaging hole 102a provided therein to insert the locking rod 100. A spring 104 serves to hold the locking rod 100 to be removed out of the engaging hole 102a in the engaging member 102 by urging the armature 98a to be normally moved in a leftward direction as viewed in FIG. 25. Therefore, when the linear solenoid 98 is energized, the armature 98a is magnetically attracted against the spring 104 in a rightward direction as viewed in FIG. 25 to insert the locking rod 100 into the engaging hole 102a in the engaging member 102, which causes the accelerator interlocking member 26 and the throttle interlocking member 28 to be integrally locked to each other. In FIGS. 20 and 25, a reference numeral 106 designates a guide member to guide the locking rod 100.

The operation of the accelerator erroneous operation preventing device 10 in accordance with the fourth embodiment is substantially identical to those of the first through third embodiments. However, since an arrangement of the components is different from those of the first through third embodiments, an outline of the operation of the fourth embodiment will be described hereinjustbelow.

FIG. 23 shows the accelerator pedal 14 erroneously pushed down in spite of the brake being intended to be applied while the vehicle is driven with the foot being released from the accelerator pedal 14. In this case, as shown in FIG. 23, the accelerator interlocking arm portion 92B or the accelerator interlocking member 26 is pivotally moved about the pin 94 while the throttle interlocking arm portion 92A or the throttle interlocking member 28 is left almost at the original position so as to release the accelerator interlocking member 26 and the throttle interlocking member 28 from the magnetic coupling condition thereof in accordance with the urging force applied to the throttle cable in a direction in which the throttle valve is opened, the mass of the whole throttle interlocking member 28, the leverage of the accelerator interlocking arm portion 92B and the set magnetic force of the permanent magnets 38 and 38A before the throttle interlocking member 28 is moved together with the accelerator interlocking member 26.

Thus, the throttle cable (not shown) is hardly pulled in spite of the accelerator pedal 14 being erroneously pushed down even though the brake pedal intends to be pushed down and therefore the vehicle is never accelerated.

Next, FIG. 22 shows the accelerator pedal 14 pushed down with the pedalling force equal to or more than the pedalling force applied to the brake pedal, in case that the vehicle is driven while the accelerator is normally operated. In this case, as shown in FIG. 22, although the stop body 56 of the stop member 50 on the throttle interlocking arm portion 92A or the throttle interlocking member 28 is engaged against the floor 20B so as not to be further moved down, the accelerator interlocking arm portion 92B or the accelerator interlocking member 26 can be pushed down while the stop body 54 of the first stop member 48 is deformed. This causes the permanent magnet 38A on the accelerator interlocking member 26 to be released from being magnetically coupled with the permanent magnet 38 on the throttle interlocking member 28. Thus, the throttle interlocking member 28 is immediately returned by the throttle cable normally urging the throttle valve to be closed to the position where the accelerator is released (the position corresponding to one of FIG. 23), which causes the accelerator to be prevented from being erroneously operated.

Since the accelerator interlocking member 26 and the throttle interlocking member 28 are normally integrated with each other by the permanent magnets 38 and 38A, the whole accelerator arm 16 can be pivotally moved in accordance with the pedalling distance of the accelerator pedal 14 while the condition of FIG. 20 is maintained, so that the accelerator is normally operated.

In case that there is required no consideration of the erroneous operation of the accelerator, the linear solenoid 98 of the lock means 62 is energized to magnetically attract the armature 98a. This causes the locking rod 100 integral to the armature 98a to be inserted into the engaging hole 102a in the engaging member 102 as shown in FIG. 24 so as to integrate the accelerator interlocking member 26 with the throttle interlocking member 28. Thus, since the accelerator arm 16 and the throttle cable 18 are integrally connected with each other, the vehicle can be driven while the accelerator is normally operated.

In the fourth embodiment, the erroneous operation the first embodiment. FIG. 20 shows only the switching element 80 of the erroneous operation warning means 76, which is connected to the warning circuit identical to the warning circuit 82 of the first embodiment. The erroneous operation warning means 76 is shown to be omitted in FIGS. 21 through 24.

An embodiment in which the invention is applied to an electric vehicle is shown in FIG. 26 and the succeeding figures. The electric vehicle 200 comprises an electric motor 202 controlled by a controller 201 and rotatably driven by a battery not shown. Wheels 203 are driven by the electric motor 202 through a differential gear 204.

The controller 201 receives a speed signal S from a variable resistor 205 which is displaced by an accelerator pedal 214 to drive the electric motor 202 at the speed corresponding to the speed signal S. The speed of the electric vehicle may be controlled by a battery system, a pulse width modification system (PWM system) or the like so long as the speed can vary by pushing down the accelerator pedal 214 other than the aforementioned resistance variation system.

An erroneous operation preventing device 210 applied to the electric vehicle may be provided with magnetic coupling sensor means 230 comprising an accelerator interlocking member 226 mounted on an accelerator arm 216 interlocking with the accelerator pedal 214, a follower member 228 urged to be moved in a direction opposite to the pedalling direction of the accelerator pedal 214 (in a leftward direction as viewed in FIG. 26) and magnetically coupled with the accelerator interlocking member 226 to be moved following the accelerator interlocking member 226 and a switch element 280 serving to detect that the accelerator interlocking member 226 is released from being magnetically coupled with the follower member 228 to generate an accelerator erroneous operation signal.

In the illustrated embodiment, the magnetic coupling sensor means 230 may be substantially identical to the magnetic coupling means 30 except that the magnetic coupling sensor means 230 may have the follower means 228 by which the throttle interlocking member 28 of the magnetic coupling means 30 shown in FIGS. 1 through 8 may be replaced and that the switch element 280 is added thereto.

Of course, the accelerator erroneous operation preventing device 210 for the electric vehicle comprises stop means 246 to stop the follower member 228 from further moving beyond the furthermost pedalling position of the normal operation of the accelerator, position control means 258 to control the position of the follower member 228 to stop it

from further moving in a leftward direction as viewed in FIG. 26 from the position of FIG. 26, lock means 262 to lock the accelerator interlocking member 226 and the follower member 228 from being released from the magnetic coupling condition thereof when there is required no function of preventing the accelerator from being erroneously operated and erroneous operation warning means to warn to a driver that the accelerator is erroneously operated, which are identical to the stop means 46, the position control means 58, the lock means 62 and the erroneous operation warning means 76 which the device of the first embodiment comprises.

In the illustrated embodiment, the erroneous operation warning means 276 may comprise a warning circuit 282 driven by a signal received from the switch element 280 of the magnetic coupling sensor means 230. The warning circuit 282 may include a warning device 282A such as a buzzer and a speech synthesis system 282B, which are identical to those of the warning circuit 82 of the first embodiment.

Urging means 300 to urge the follower member 228 in a leftward direction as viewed in FIG. 26 comprises a spring-wound type wire 303 which is formed of wire 302 urged to be wound by a spring and mounted on a flame 301 suspending from a vehicle body 220. As shown in FIG. 29, the urging means 300 may comprise a wire 305 extending through a pully block 304 mounted on the flame 301 and a weight 306 mounted on the end of the wire 305. As shown in FIG. 30, it may comprise a wire 308 connected through a spring 307 to the flame 301. In either of the cases, the front ends of the wires 302, 305 and 308 (the righthand ends as viewed in FIGS. 26, 29 and 30) extend through an extending hole 220*a* in a wall 220A of the vehicle body and a tapered extending hole 234*c* in a holder 234 of the follower member 228 and is stopped from being removed out of the holder 234 by a spherical engaging body 244. The urging means 300 of FIG. 29 may comprise a cylindrical guide member 309 secured to the vehicle body 220 by any suitable means to guide the weight 306 only in a vertical direction so as to prevent the weight 306 from being laterally oscillated during the operation of the vehicle. The variable resistor 205 has a wiper 205*a* mounted on the engaging member 242 of the follower member 228 to make the resistance variable. Thus, the variable resistor 205 generates the speed signal S varying in accordance with the pedalling position of the accelerator pedal 214 and the electric motor 202 is rotatably driven in accordance with the variable speed signal S.

The other corresponding components of the accelerator erroneous operation preventing device 210 to which the invention is applied are designated by reference numerals having "200" added to the corresponding reference numerals of the first embodiment because they are identical to those of the first embodiment and the detail description thereof will be omitted.

Since the operation of the accelerator erroneous operation preventing device 210 which is applied to the electric vehicle 200 is substantially identical to that of the first embodiment except that when the accelerator erroneous operation signal is generated from the switch element 280 of the magnetic coupling sensor means 230 by erroneously operating the accelerator, the controller 201 disables the operation of the electric motor 202, the detailed description thereof will be omitted. When the accelerator pedal 214 is pushed down during the normal operation of the accelerator, the wiper 205*a* mounted on the engaging body 242 of the follower member 228 is slidably moved, which causes the variable resistor 205 to generate the speed signal S corresponding to the pedalling position of the accelerator pedal 214 and the electric motor 202 to rotate at the speed in accordance with the speed signal, which is different from the first embodiment in which the revolution of the engine is controlled by adjusting the opening degree of the throttle valve in accordance with the pedalling distance of the accelerator pedal 14.

The accelerator erroneous operation preventing device applied to the electric vehicle may be constructed in accordance with any of the second and third embodiments as well as in accordance with the first embodiment shown in FIGS. 1 through 8.

Although any of the magnetic coupling means 30 of the first through fourth embodiments and the magnetic coupling sensor means 230 for the electric vehicle may have the permanent magnets 38, 38A or 238 used therefor, they may be electromagnets. The permanent magnets or the electromagnet may be mounted not on the side of the throttle interlocking member 28 or the follower member 228, but on the side of the accelerator interlocking member 26 or 226 while the attraction plate may be mounted on the throttle interlocking member 28 or the follower member 28. Further, the magnet or magnets may be mounted on both sides of the accelerator interlocking member 26 or 226 and of the throttle interlocking member 28 or the follower member 228.

INDUSTRIAL UTILITY

In this manner, the accelerator erroneous operation preventing device of the present invention never accelerates the engine and the vehicle even though the accelerator pedal is erroneously pushed down because the throttle valve is never opened. More particularly, the accelerator erroneous operation preventing device can immediately stop the throttle valve from being opened without any time delay after the erroneous operation of the accelerator because the accelerator pedal is so arranged that it is disconnected from the operating side of the throttle valve. Also, the accelerator erroneous operation preventing device can prevent the accelerator from being erroneously operated almost while the throttle valve is kept closed in accordance with the operation of initiating to erroneously push down the accelerator pedal.

Furthermore, when the accelerator of the electric vehicle is erroneously operated, the erroneous operation signal is supplied to the controller to prevent the erroneous operation. In many cases, the electric vehicle is driven without contacting the accelerator pedal, which will be different from the engine mounting vehicle, and therefore the magnetic coupling sensor means can generate the erroneous operation signal immediately after the accelerator pedal is initially pushed down from the original position, which causes the accelerator to be effectively prevented from being erroneously operated without any acceleration of the electric motor.

Furthermore, in any case, as the accelerator pedal is released from the foot of the driver, who notices the erroneous operation of the accelerator, the accelerator system can be immediately returned to the original normal condition and thereafter the accelerator can be again normally operated.

The erroneous operation preventing device of the invention can be commercially available as an independent assembly together with the accelerator pedal, which allows them to be easily assembled in the existing vehicles.

I claim:

1. A device for preventing an accelerator from being erroneously operated for a motor vehicle comprising mag-

netic coupling means including an accelerator interlocking member interlocking with an accelerator pedal (14) of said motor vehicle and a throttle interlocking member associated with a throttle valve so as to open and close said throttle valve and being magnetically coupled with said accelerator interlocking member, said magnetic coupling means being so magnetically set that said accelerator interlocking member is released from said throttle interlocking member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to said accelerator pedal.

2. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 1, and either of said accelerator interlocking member and said throttle interlocking member of said magnetic coupling means include magnetic material or a magnet while the other includes a magnet.

3. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 1, and further comprising lock means to releasably lock the magnetic coupling condition of said accelerator interlocking member and said throttle interlocking member.

4. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 1, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling means is provided on a side of said accelerator arm opposite to said accelerator pedal relative to a pivotal point of said accelerator arm.

5. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 1, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling means is provided on a side of said accelerator arm having said accelerator pedal relative to a pivotal point of said accelerator arm.

6. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 1, and further comprising erroneous operation warning means to warn the erroneous operation of said accelerator, said erroneous operation warning means including switch means to detect that said accelerator interlocking member and said throttle interlocking member are released from the magnetic coupling condition and a warning circuit to warn the erroneous operation of the accelerator in accordance with a signal generated by said switch means to detect said release from said magnetic coupling condition.

7. A device for preventing an accelerator from being erroneously operated for a motor vehicle comprising magnetic coupling means including an accelerator interlocking member interlocking with an accelerator pedal of said motor vehicle and a throttle interlocking member associated with a throttle valve so as to open and close said throttle valve and being magnetically coupled with said accelerator interlocking member and stop means including a stop body formed of deformable material serving to stop said accelerator interlocking member from further moving beyond the furthermost pedalling position of the normal operation of said accelerator when said accelerator interlocking member moves without deforming said stop body, but to allow said accelerator interlocking member to move beyond said furthermost pedalling position of the normal operation of said accelerator to allow said accelerator interlocking member and said throttle interlocking member to be released from being coupled with each other when said accelerator interlocking member moves beyond said furthermost pedalling position and said stop body is deformed.

8. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, wherein either of said accelerator interlocking member and said throttle interlocking member of said magnetic coupling means include magnetic material or a magnet and the other includes a magnet.

9. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, and said magnetic coupling means being so magnetically set that said accelerator interlocking member is released from said throttle interlocking member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to said accelerator pedal.

10. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, further comprising a second stop member serving to stop moving of said throttle interlocking member so that it is released from being magnetically coupled with said accelerator interlocking member without any further movement of said throttle interlocking member in the accelerating direction while said first stop member is deformed when said accelerator pedal is pushed down beyond said furthermost pedalling position in the normal operation of said accelerator.

11. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 10, and said first stop member is formed of resilient material to be deformed by pushing down said accelerator pedal beyond the normal operation of said accelerator.

12. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 10, and said first stop member is formed of plastically deformable material to be plastically deformed to allow said accelerator interlocking member to be moved to a position where said accelerator interlocking member is released from being magnetically coupled with said throttle interlocking member by pushing down said accelerator pedal beyond the normal operation of said accelerator.

13. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, further comprising guide means to to guide linear forward and backward movement of said accelerator interlocking member while it is coupled to said throttle interlocking member.

14. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, and further comprising lock means to lock said accelerator interlocking member and said throttle interlocking member when coupled.

15. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling means is provided on a side of said accelerator arm opposite to said accelerator pedal relative to a pivotal point of said accelerator arm.

16. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling means is provided on a side of said accelerator arm having said accelerator pedal relative to a pivotal point of said accelerator arm.

17. A device for preventing an accelerator from being erroneously operated for a motor vehicle as set forth in claim 7, and further comprising erroneous operation warning

means to warn the erroneous operation of said accelerator, said erroneous operation warning means including switch means to detect that said accelerator interlocking member and said throttle interlocking member are released from the magnetic coupling condition thereof and a warning circuit to warn the erroneous operation of said accelerator in accordance with a signal generated by said switch means to detect said release from said magnetic coupling condition.

18. A device for preventing an accelerator from being erroneously operated for an electric vehicle characterized by comprising magnetic coupling sensor means including an accelerator interlocking member interlocking with an accelerator pedal of said electric vehicle, a follower member urged to be moved in a direction opposite to an accelerating direction of said accelerator pedal and being magnetically coupled with said accelerator interlocking member to move following said accelerator interlocking member and a switch element to detect that said accelerator interlocking member and said follower member are released from being magnetically coupled with each other to generate an accelerator erroneous operation signal, said magnetic coupling sensor means being so magnetically set that said accelerator interlocking member is released from said follower member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to said accelerator pedal and being connected to a controller of said electric vehicle so that said accelerator erroneous operation signal from said switch element serves to prevent said controller from controlling said electric vehicle in an accelerating direction thereof.

19. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 18, and either of said accelerator interlocking member and said follower member for said magnetic coupling sensor means includes magnetic material or a magnet while the other includes a magnet.

20. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 18, and further comprising lock means to releasably lock the magnetic coupling condition of said accelerator interlocking member and said follower member.

21. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 18, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling sensor means is provided on a side of said accelerator arm opposite to said accelerator pedal relative to a pivotal point of said accelerator arm.

22. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 18, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling sensor means is provided on a side of said accelerator arm having said accelerator pedal relative to a pivotal point of said accelerator arm.

23. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 18, and further comprising erroneous operation warning means to warn the erroneous operation of said accelerator, said erroneous operation warning means including switch means to detect that said accelerator interlocking member and said follower member are released from the magnetic coupling condition thereof and a warning circuit to warn the erroneous operation of said accelerator in accordance with a signal generated by said switch means to detect said release from the magnetic coupling condition.

24. A device for preventing an accelerator from being erroneously operated for an electric vehicle comprising magnetic coupling sensor means including an accelerator interlocking member interlocking with an accelerator pedal of said electric vehicle and a follower member urged to be moved in a direction opposite to an accelerating direction of said accelerator pedal and being magnetically coupled with said accelerator interlocking member to move following said accelerator interlocking member and stop means including a stop body formed of deformable material serving to stop said follower member from further moving beyond the furthermost pedalling position of the normal operation of said accelerator when said accelerator interlocking member moves without deforming said stop body, but to allow said accelerator interlocking member to move beyond said furthermost pedalling position of the normal operation of said accelerator to allow said accelerator interlocking member and said follower member to be released from being magnetically coupled with each other when said accelerator interlocking member moves beyond said furthermost pedalling position and said stop body is deformed.

25. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, wherein either of said accelerator interlocking member and said follower member of said magnetic coupling sensor means includes magnetic material or a magnet and the other includes a magnet.

26. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, and said magnetic coupling sensor means being so magnetically set that said accelerator interlocking member is released from said follower member as soon as a pedalling force equal to or more than a pedalling force applied to a brake pedal is abruptly applied to said accelerator pedal.

27. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, further comprising a second stop member (250) serving to stop moving of said follower member so that it is released from being magnetically coupled with said accelerator interlocking member without any further movement of said follower member in the accelerating direction while said first stop member is deformed when said accelerator pedal is pushed down beyond said furthermost pedalling position in the normal operation of said accelerator.

28. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 27, and said first stop member is formed of resilient material to be deformed by pushing down said accelerator pedal beyond the furthermost pedalling position in the the normal operation of said accelerator.

29. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 27, and said first stop member is formed of plastically deformable material to be plastically deformed to allow said accelerator interlocking member to be moved to a position where said accelerator interlocking member is released from being coupled with said follower member by pushing down said accelerator pedal beyond the furthermost pedalling position in the normal operation of said accelerator.

30. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, and further comprising lock means to lock said accelerator interlocking member and said follower member from being uncoupled from each other.

31. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, and wherein an accelerator arm having said

accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling sensor means is provided on a side of said accelerator arm opposite to said accelerator pedal relative to a pivotal point of said accelerator arm.

32. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, and wherein an accelerator arm having said accelerator pedal mounted thereon is pivotally mounted on a vehicle body and said magnetic coupling sensor means is provided on a side of said accelerator arm having said accelerator pedal relative to a pivotal point of said accelerator arm.

33. A device for preventing an accelerator from being erroneously operated for an electric vehicle as set forth in claim 24, and further comprising erroneous operation warning means to warn the erroneous operation of said accelerator, said erroneous operation warning means including a warning circuit to warn the erroneous operation of said accelerator in accordance with a signal generated by switch means to detect said release from the magnetic coupling condition.

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